

Comprehensive Fishery Survey of Lake Kegonsa

Dane County, Wisconsin 2016



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Summary

Lake Kegonsa is a 3209-acre, complex fish community-warm turbid lake, located at latitude 42.9645909, longitude, -89.2536477 in Dane County, with a max depth of 31 feet, and an average depth of 16.7 ft. In 2016, Wisconsin Department of Natural Resources (WDNR) fishery management crews conducted a comprehensive fishery assessment on the lake (WBIC 802600) including a spring fyke netting (SN1) survey targeting northern pike and walleye, spring electrofishing (SE1) targeting spawning walleyes to compute a population estimate, spring electrofishing (SE2) targeting largemouth and smallmouth bass and panfish, and fall electrofishing (FE) surveys targeting young-of-year (YOY) and adult walleye to assess recruitment (natural recruitment and stocking).

Spring Fyke net surveys began shortly after ice out on 3/13/2016 and ended 32 days later (4/14/2016). Nets were checked and emptied daily. Twenty-seven species were observed during the survey (Table 1). Bluegills were the most abundant species sampled (1563) with a mean size of 6.44" with the largest fish recorded at 10.2". Other fish included Yellow Bass (862) and were the second most common species with an average size of 7.00" with fish up to 12.00" recorded. Black Crappies (423) ranged from 3" to 12", White Bass (414) ranged from 4.6 to 15.7", Yellow Perch (15) ranged from 5.7 to 11.5". Other panfish sampled included pumpkinseeds, rockbass, warmouth, green sunfish, and bluegill x green sunfish hybrids.

Walleye (509) ranged from 7.4" to 28.3" with an average size of 15.92" with a population estimate of 1.93 fish per acre (6191 fish). Northern Pike (322) ranged from 9.2 to 40.3" with an average size of 24" with a population estimate of 0.65 fish per acre (2095 fish). Largemouth bass (60) ranged from 5.1" to 19.7", smallmouth bass ranged from 7.8" to 15.3" and Muskellunge ranged from 24.9" to 44.5" with an average size of 36.4". We also observed included black bullhead, brown bullhead, yellow bullhead, bowfin, common carp, freshwater drum, and several species of shiners.

Management objectives for gamefish and rough fish have been developed to improve the fishery and water quality of the lake. Walleye YOY recruitment should average >10 per mile over a three-year period while maintaining or improving the adult population to 3 per acre. The northern pike population should be increased to 1.5 fish per acre and increase the number of fish above the legal limit. Panfish abundances are currently low and should be increased to values observed in other similar lakes. Largemouth bass abundances are low but stable and should be increased to 14.5 per mile of electrofishing and smallmouth bass size structure could be improved to include a higher percentage of 11-17" fish. A broader management objective encompassing all gamefish species is to assess the interest of anglers and stakeholders to modify existing size and bag limit regulations to improve size structure and density of the fishery. Also, I strongly encourage and support common carp removal efforts to reduce the population to < 100lbs per acre. Lastly, conducting a comprehensive angler creel survey on Lake Kegonsa to examine angler attitudes, preferences, effort, and parse angler exploitation versus natural mortality remains a high fishery management priority but would require additional funding.

Acknowledgements

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INTRODUCTION

Background

Lake Kegonsa, Dane County
T6N, R10E Sections 13, 23,24,25,26
T6N, R11E Sections 18, 19,20,29,30
GPS: 42.965085, -89.253723

Physical/chemical attributes

Morphometry: 3209 acres, maximum depth of 32 feet, 10 miles of shoreline (1.5 miles public).

Watershed Area: 54 square miles

Lake type: Drainage with flowing inlets and outlets.

Water Clarity: Turbid

Trophic Status: Hypereutrophic

Fish Consumption Advice: Lake Kegonsa fish consumption advisory is within the general Dane County Consumption Advice. The following guidelines are in response to Mercury concerns.

Women up to age 50 (child bearing age) and children (under 15) may safely eat:

1 meal per week	Bluegills and sunfish, bullheads, crappies, inland trout, yellow perch
1 meal per month	Bass, catfish, northern pike, walleye, all other species and sizes
Do not eat	Muskellunge

All men (15 and older) and older women (50 and older) may safely eat:

Unrestricted	Bluegills and sunfish, bullheads, crappies, inland trout, yellow perch
1 meal per week	Bass, catfish, northern pike, walleye, all other species and sizes
1 meal per month	Muskellunge

More information can be found here: <https://dnr.wi.gov/fcsexternaladvqry/fishadvisorysrch.aspx>

Aquatic vegetation: Low abundance with low diversity in last decade but improving in recent years. See link to Dane County Reports detailing vegetation management plans and statistics. Changes in Lake Kegonsa aquatic plant coverage are detailed later in this report.

Requires free Adobe™ Reader software, visit: <https://wred-lwrd.countyofdane.com/Aquatic-Plant-Management>, and select the links under “Lake Kegonsa”.

Winterkill: not a winterkill lake.

Access: four boat launches: Fish Camp (Dane County Parks), Williams Point Drive (Town of Pleasant Springs), Lake Kegonsa State Park (WDNR), Amundsons Landing (WDNR). Shore fishing is available within the 1.5 miles of public shorelines on the north and north-east shores at Fish Camp park and Lake Kegonsa State Park.

Fish Habitat

The Yahara river inlet/ outlet, main lake points, and large rock bars are the primary fish habitat features in the lake. The Yahara river offers current and current-breaks that draw and hold fish in different seasons and the main point breaks provide steep shorelines that adjacent to greater water depths; often holding predator gamefish at the thermocline. The sandy substrates and developed shorelines are a challenge in terms of maximizing fish habitat; only about 1.5 miles of the shore is natural and undeveloped. WDNR and local partner organizations have placed fish cribs in various locations around the lake in the last 20 years. These structures may provide fish cover and do give anglers a place to target them. The aquatic vegetation and cover has increased in recent years and will provide nursery areas for developing fish.

Stocking

Lake Kegonsa was stocked regularly by WDNR with large fingerling (5-7") northern pike and walleye small fingerlings (~1-4"). Additional private stocking permits were issued for large fingerling walleye from 2010-2015 using private funds and privately sourced fish, see Table 2 (Figure 3) for additional information including specific years, sizes, and numbers of stocked fish. The privately stocked walleye were fin clipped in 2013 and 2014 to allow for evaluation of their contribution to the population. Supplemental stocking of walleye was conducted because natural reproduction was thought to be limited. Northern Pike were stocked because the lake was used as a brood source for WDNR hatcheries. This means northern pike eggs were removed from the lake each year and taken to the hatchery, therefore, we stocked back some of the hatchery raised fish into Kegonsa to compensate for the lost recruitment potential. Lake Kegonsa was stocked annually with ~ 2500 northern pike large fingerlings (Table 2).

Regulations: additional information can be found here: <https://dnr.wi.gov/topic/fishing/regulations/>

Species	Season	Regulation
Catfish	Open All Year	No minimum length limit and the daily bag limit is 10.
Panfish (bluegill, pumpkinseed, sunfish, crappie and yellow perch)	Open All Year	No minimum length limit and the daily bag limit is 25.
Largemouth bass and smallmouth bass	May 5, 2018 to March 3, 2019	The minimum length limit is 14" and the daily bag limit is 5.
Muskellunge and hybrids	May 5, 2018 to December 31, 2018	The minimum length limit is 40" and the daily bag limit is 1.
Northern pike	May 5, 2018 to March 3, 2019	The minimum length limit is 26" and the daily bag limit is 2.
Walleye, sauger, and hybrids	May 5, 2018 to March 3, 2019	The minimum length limit is 15" and the daily bag limit is 5.
Bullheads	Open All Year	No minimum length limit and the daily bag limit is unlimited.
Lake sturgeon	Closed	No fishing allowed.
Rock, yellow, and white bass	Open All Year	No minimum length limit and the daily bag limit is unlimited.

Current Management Goals

- Panfish - Harvest oriented fishery
- Walleye - Harvest oriented fishery
- Largemouth and Smallmouth Bass – Quality fishing opportunity with increased size structure
- Northern Pike - Quality fishing opportunity with increased size structure
- Muskellunge – Not actively managed, fish present are migrants from upstream.

METHODS

Data collection-spring netting and electrofishing

Field sampling followed Standard Wisconsin DNR survey protocols (Fish Management Handbook chapter 510). Following ice-out, standard 4x6 foot frame fyke nets with 0.75-inch, 1.5 inch stretch mesh were set in typical fish spawning and migration corridors (river inlets and outlets, points, steep shorelines) on March 13, 2016; these nets targeted northern pike and walleye (SN1). Gamefish were measured to the nearest 0.1 inch and a subsample of each species was weighed using digital hanging scales. Aging structures were collected from a subsample of bluegills, black crappies, largemouth bass, smallmouth bass, northern pike, and walleye. The goal was to take structures from 5 fish per half-inch group for bluegills, black crappie, yellow perch, largemouth bass, and smallmouth bass. Since sex could be determined in adult spawning northern pike and walleye, our quota for age groups for these species was 5 structures per half-inch group from each sex. Sex was determined by observed presence of running eggs or milt. Calcified structures (dorsal spines and anal fin rays) were used to estimate ages of a subsample of each species of interest. Spines or fin rays were removed in the field, air dried in the lab, mounted in epoxy, cross-sectioned using a low-speed saw, and polished until annuli are clearly visible under a standard dissecting microscope. Two experienced readers independently reviewed each fish structure and reach a consensus age estimate for each fish. These data were used to generate mean length-at-age estimates. For all fish species, (except northern pike and walleye) with age data, mean length-at-age estimates were pooled for male and females, generating a composite growth trajectory (see Appendix Table 2 for net locations).

A WDNR standard pulsed direct current (DC) boom shocker boat was used to sample fish on Lake Kegonsa during the spring and fall of 2016. The electrofishing survey targeting adult walleye for a population estimate occurred on the night of April 14, 2016 (SE1). The survey was conducted along the entire shoreline of the lake. An additional 4-mile electrofishing survey occurred on May 10, 2016 (SE2) targeting all gamefish. Fall Electrofishing (FE) to assess recruitment of young of the year fish was completed on September 27 and 28 and included 4 miles of shoreline. Four-mile SE2 electrofishing surveys were conducted in spring of 2017 (May 8) and 2018 (May 15) (Appendix Figure 1).

During the spring fyke netting survey, adult walleyes (expressing gametes or >15") and northern pike >12" were marked with a top caudal fin clip. The Spring Electrofishing survey (SN1) conducted on April 14, 2016 served as the recapture portion of the assessment; all marked and unmarked fish were recorded.

In 2012, 2017, 2018 WDNR staff performed BioBase™ plant surveys to monitor aquatic vegetation in the lake. An HDS Lowrance™ transducer sonar unit with add-on software was used to map the density and extent of aquatic plants in the lake. Using mapping software, we overlaid lines perpendicular to the shore every 50 meters allowing the boat driver a point of reference to follow. Along each line, the sonar recorded the density and extent of vegetative cover, any gaps in the transect data are interpolated. We restricted our 50 meter transects to the photic zone (depths of 15 feet or less). This is typically the maximum depth of rooted aquatic plant growth. WDNR crews mapped the entire photic zone of the lake in this manner.

Data Analysis

Catch rates are reported by survey type (SN1, SE1, SE2, FE). The walleye population estimate (number of fish \geq length 15") was calculated using the Chapman modification of the Petersen single-census method where fish were marked during multiple fyke netting events, followed by a single recapture event (SE1). Northern pike population estimates were generated using the Schnabel multiple recapture event method. Relative abundance was evaluated using catch rates for selected gamefish species using spring electrofishing and fyke net surveys for lakes with similar physical and chemical characteristics as Lake Kegonsa.

Length frequency distributions were generated for species of interest, including bluegill, black crappie, yellow perch, northern pike, smallmouth bass, largemouth bass, and walleye. Temporal trends in size-specific catch rates were calculated for all gamefish species using available data following the length categories detailed in Anderson & Neuman (1996), see Appendix Table 1.

Age and growth demographics were detailed for game and panfish species where data allowed and were compared to lakes with similar physical and chemical characteristics as Lake Kegonsa for added context. Mean Length at age was computed by pooling each fish within an age class and comparing the observed length class for each species (and sex for walleye and northern pike). The aged subsample was used to develop an age-length key and applied to all fish in the survey. Age and length data were applied to age-length keys to estimate the age frequency of the whole population based on the aged subsample. Age frequency distributions were generated for each species allowing for inferences about year class strength and total instantaneous mortality rates. The total instantaneous mortality rates represent all mortality including natural, angler harvest, hooking, and predation. Without additional intensive sampling including comprehensive angler creel surveys, gut content analyses, and more robust forage fish sampling, we are not able to parse individual sources of mortality at a higher resolution.

Relative weights were calculated to evaluate body condition of fish. Relative weight (W_r) is a tool that compares the weight of the fish to an expected weight for that length. Standard weights for individual fish of each species were only calculated for fish larger than the minimum recommended length for each species. Relative weights for each fish were calculated by dividing a fish's actual weight by the standard weight for a fish of that length. Average relative weight was then calculated for each species. Relative weight values between 75 and 100 indicate normal weight for a given length. A relative weight value greater than 100 indicates that a fish is in excellent condition. A relative weight value less than 75 indicates that a fish is in poor condition. Relative weights were computed for walleyes, northern pike, largemouth bass, and bluegills.

RESULTS

General Catch Summary

Bluegills were the most abundant species sampled (1563) with a mean size of 6.4" with the largest recorded at 10.2". Other panfish included Yellow Bass (862) and were the second most common species with an average size of 7.0" with fish up to 12.0" recorded. Black Crappies (423) ranged from 3.0" to 12.0", White Bass (414) ranged from 4.6 to 15.7", Yellow Perch ranged from 5.7 to 11.5". Other fish sampled included pumpkinseeds, rockbass, warmouth, green sunfish, yellow and white bass, and bluegill x green sunfish hybrids (see Table 1, Table 3, Supplementary Material for additional information).

Walleye (509) ranged from 7.4" to 28.3" with an average size of 15.9". Northern Pike (322) ranged from 9.2 to 40.3" with an average size of 24". Largemouth bass (60) ranged from 5.1" to 19.7", smallmouth

bass ranged from 7.8" to 15.3" and Muskellunge ranged from 24.9" to 44.5" with an average size of 36.4". Other species observed included black bullhead, brown bullhead, yellow bullhead, bowfin, common carp, freshwater drum, and several species forage species. See Table 3 for size-specific catch rates of gamefish and species for seasonal electrofishing and netting efforts.

Additional information including size-specific catch rates, size demographics, and catch-per-unit-effort for electrofishing and fyke netting (CPUE) for years 2001 to 2017 are detailed in the end of this report under the "Supplementary Material" heading, embedded in the Excel spreadsheet entitled "Kegonsa 2001_2018 summary statistics".

Walleye size, age, and population structure in Lake Kegonsa

A total of 563 walleye were captured in fyke nets and electrofishing surveys. Fish ranged from 7.4-28.3" with an average length of 15.9" (Table 1, Figure 1). WDNR marked 429 adult walleyes in the fyke netting surveys, captured 143 during the electrofishing survey, of which, 9 had been previously marked. Therefore, the population estimate for adult walleyes in Lake Kegonsa is approximately 6191 adult fish, or 1.93 fish per acre (upper 95% CI of 12104 fish and lower 95% CI of 3423 fish, CV = 29%). Lake Kegonsa walleye relative abundance was 2.09 per net night which is below the median of similar lakes which was 2.8 per net night (Figure 8).

The fall electrofishing walleye recruitment survey showed evidence of strong recruitment in 2016 (i.e. fish \leq 6-9", Figure 2). Size-specific catch rates for walleyes were calculated using electrofishing survey data and expressed in Total, Young-of-year (YOY, less than 10"), 10" Stock, 15" Quality, 20" Preferred, 25" Memorable, and 30" Trophy size classes per mile of electrofishing (Figure 4). A catch rate of 24.6 YOY per mile was well above the minimum threshold of 10 YOY per mile typically associated with successful year-class strength (Figure 5). Walleye recruitment in Lake Kegonsa was variable, between 2 and 30 per mile, but there were no years with year class failures (Figure 5).

Walleye in Lake Kegonsa had above average growth trajectories and scope for growth; they grew faster and reached longer sizes than their cohorts in similar lakes (Figure 6) and females grew faster than males (Figure 7). However, there was a reduction in growth between age-3 and age-6. Walleye reached the legal harvest length between 3 and 4 years of age. The mean length at age graph shows a flattening of the growth curve at ages 4, 5, and 6 (Figure 6 & 7). The longest and oldest fish was a 28" female, aged 11 years old, and most fish were between three and six years old (Figure 9). Total instantaneous mortality rates, catch curves, and length-at-age keys were developed using the sub-sampled age estimates derived from dorsal spines. 157 walleyes were aged (see Appendix Table 3) and applied to 504 fish in the larger sample (see Figure 9). There was a very strong year class of age 3 walleyes which corresponded with 2013 fall recruitment data (Figure 5). The slope of the age-4 to the age-11 fish was used to estimate total instantaneous mortality rate (42%), which represents all mortality including natural, angler harvest, hooking, and predation (Figure 10).

Walleyes were in good to excellent body condition based on relative weights; only 5% of fish in the survey were in poor body condition (Figure 11).

Northern Pike size, age, and population structure in Lake Kegonsa

We sampled 322 Northern Pike during the spring netting survey, ranging in size from 9" to 39" with an average size of 24" (Figure 12, Table 1). We marked 306 northern pike for the Schnabel mark-recapture

population estimate which yielded an estimated 2095 fish (0.65 per acre) with an upper confidence interval of 3222 fish and a lower confidence interval of 1495 fish. It is important to note that since pike spawn in a variety of locations both within the littoral habitat of the lake and within tributaries, our methods could have underestimated the population (Pierce 2011). Lake Kegonsa northern pike catch rate of 1.3 per net night was below the median of similar lakes (2.15 per net night; Figure 15). Comparing the three most recent spring fyke net catch rates indicated the population was relatively stable since 2001 in all size classes; there were observed declines from the 2001 to 2008 survey, but by the 2016 survey, the size structure across all ranges had increased to near 2001 levels (Figure 16).

We sub-sampled male and female northern pike for age demographics, yielding mean length-at-age estimates that we compared to other lakes. Northern Pike in Lake Kegonsa had excellent growth trajectories (Figure 13); they grew faster and reached longer sizes than their cohorts in similar lakes and females grew larger than males (Figure 14). They reached the legal harvest size between ages 4 and 5 (Figure 13), with some females reaching 26 inches by age 3 (Figure 14). There was a flattening of the growth curve at ages 4 and 5. One-hundred sixty-four northern pike were aged using anal fin rays (see Appendix Table 4) and then applied to 317 fish in the larger sample (Figure 17). Most fish were between three and five years old, the longest recorded was a 39" female, aged at 9 years old. The slope of the age-4 to the age-10 fish was used to estimate total instantaneous mortality rate (35%) which represented all mortality including natural, angler harvest, hooking, and predation (Figure 18).

Northern pike in the lake were in good to excellent body condition based on relative weights; only 7% of fish in the survey were in poor body condition (Figure 19).

Bluegill size, age, and population structure in Lake Kegonsa

Bluegills were the most abundant species sampled (1563) with a mean size of 6.5" and the largest fish recorded at 10.2". The largest fish in our samples was a 10", seven-year-old specimen. Bluegill size distribution was similar between our spring fyke net surveys and our electrofishing efforts. Most fish were in the 5-7" range with fish up to 10.5" that offered a fishing opportunity for larger fish (Figure 20, Table 1). Bluegill abundance was much lower than lakes similar to Kegonsa. For example, the median catch rate for bluegills in large complex dark lakes was 86 per mile of electrofishing whereas Kegonsa is 5.25 (Figure 22). Size-specific catch rates were calculated for spring electrofishing efforts for years 2001 through 2017 (Figure 23) which indicated a stable, albeit marked decline across all sizes since a single, high abundance year in 2005.

Bluegills in Lake Kegonsa had excellent growth rates and grew faster at each age and reached longer sizes than their cohorts in similar lakes. For example, it took a bluegill in Lake Kegonsa 7 years to reach 10" whereas it took bluegill in other lakes 10 years to grow to the same size (Figure 21). Total instantaneous mortality rates, catch curves, and length-at-age keys were developed using the sub-sampled age estimates derived from dorsal spines. 72 bluegills were aged (see Appendix Table 5) and then applied to 1129 fish in the larger sample (Figure 24). The slope of the age-3 to the age-7 fish was used to estimate total instantaneous mortality rate (35%), which represented all mortality including natural, angler harvest, hooking, and predation (Figure 25).

The bluegills were in good to excellent body condition based on relative weights; only 1 fish in the survey was in poor body condition (Figure 26).

Black Crappie size, age, and population structure in Lake Kegonsa

Black Crappies (423) ranged from 3" to 12" in our spring netting survey. There was a strong year-class of juvenile fish entering the fishery in the 4-5" range, a depressed size-class from 6-9" and some fish in the 10-12" range (Figure 27, Table 1). Black Crappie overall abundance was lower than most lakes similar to Kegonsa. For example, the median catch rate for black crappies was 8 per net night whereas Kegonsa was 1.73 per net night (Figure 29). Size-specific catch rates were calculated for spring electrofishing efforts for years 2001 through 2017. Available data showed a common theme in crappie populations: Boom and bust cycles coinciding with year-class strength (Figure 30). In Lake Kegonsa, there were strong cohorts of 5" and 8" fish evident in 2004-2005 and 2013-2014.

Black Crappie in Lake Kegonsa grew faster and reached longer sizes than their cohorts in similar lakes (Figure 28.) Sixty-nine black crappies were aged (see Appendix Table 6) and then applied to 390 fish in the larger sample (Figure 31). There appeared to be strong year classes from 2010, 2011 and 2015, which were also evident in the Electrofishing trend data (figure 30) as Quality sized fish in 2013 and then preferred sized fish in 2014. The largest fish we sampled was 12", which was aged at ten years old.

Largemouth Bass size, age, and population structure in Lake Kegonsa

Largemouth bass catches were modest in both netting and electrofishing surveys and both methods yielded similar results in terms of sizes and ages of fish. Largemouth bass ranged from 5.1" to 19.7" (Figure 32, Table 1). Largemouth bass relative abundance was lower than most lakes similar to Kegonsa (5.25 per mile versus 14.5 per mile; Figure 34). Size-specific catch rates for Lake Kegonsa Largemouth Bass from 2001-2016 indicate a modest but stable population across all size-classes since 2008 (Figure 35).

Largemouth Bass in Lake Kegonsa typically grew faster and reached longer sizes than their cohorts in similar lakes (Figure 33). All 58 fish we sampled were aged (Appendix Table 7; Figure 36). The largest fish we sampled was 19", which was aged at nine years old. Total instantaneous mortality rates, catch curves, and length-at-age keys were not developed for largemouth bass because age demographics revealed inconsistent recruitment.

Most of the largemouth bass were in good to excellent body condition based on relative weights; none of fish in the survey were in poor body condition (Figure 37).

Smallmouth Bass size, age, and population structure in Lake Kegonsa

Smallmouth bass catches were modest in both netting and electrofishing surveys and both methods yielded similar sizes and ages of fish. Smallmouth bass ranged from 8" to 17" (Figure 38, Table 1). Size-specific catch rates for Lake Kegonsa Smallmouth Bass 2001-2017 indicated a modest but stable population across all size-classes from 2001 to 2015. An increase in Stock, Quality, and Preferred size-classes in the two most recent surveys suggested conditions have been favorable for smallmouth reproduction. Continued monitoring is needed to fully understand whether this trend is sustainable or is simply a single, strong year class (Figures 39-40). Though samples sizes were relatively low, the catch rates for smallmouth bass in Kegonsa 2016 (2.25 per mile electrofishing) was higher than other similar lakes (median 2.12 per mile electrofishing) and increased in 2017 and 2018 (Figure 41).

Smallmouth Bass had growth trajectories similar to their cohorts in similar lakes, though more older fish are needed to fully evaluate the growth potential of the system (Figure 40). Total instantaneous

mortality rates, catch curves, and length-at-age keys were not developed for smallmouth bass because we only sampled 22 fish ranging in age from 2 to 6 years old (Figure 42).

Yellow Perch size, age, and population structure in Lake Kegonsa

Catches of yellow perch were modest in netting and electrofishing surveys but the netting survey yielded the most reliable data in terms of sizes and ages of fish handled (Table 1). Yellow Perch ranged from 5" to 11" (Figure 43). Total instantaneous mortality rates, catch curves, length-at-age keys, and relative weight distributions were not developed because we did not sample enough fish to accurately characterize these metrics.

Other panfish species

Yellow Bass (414) and White Bass (862) were among the most sampled fish in the survey (Table 1). Pumpkinseeds, warmouth, and rockbass were also observed. These fish serve important roles as prey resources for larger gamefish and offer additional angling opportunities all year and are important components of a healthy fish community.

Muskellunge

Muskellunge are not actively stocked or managed in Lake Kegonsa but are present because fish stocked in upstream lakes (i.e. Waubesa & Monona) migrated downstream into Lake Kegonsa. As a result, Lake Kegonsa had a modest muskellunge fishery with generally good size structure. We sampled 14 fish in our spring fyke net surveys ranging from 25" to 44" (Table 1).

Carp removal Efforts and Aquatic Vegetation Response

Contract fisherman removed 111,366 pounds of Common Carp in 2017 and 101,105 pounds in 2018, for a total of 212,471 pounds, which is just over 20% of our overall goal of having 1,000,000lbs removed over 5 years. There was a confirmed koi herpes virus outbreak in 2017 that removed an unknown number of Common Carp from the system, too. The removal contract for Lake Kegonsa has been approved and offered again in 2019.

In 2012, 2017 and 2018, WDNR staff performed BioBase™ plant surveys to monitor aquatic vegetation in the lake. There was a major increase in aquatic plant coverage and density from the first two surveys in 2012 and 2017 to the most recent 2018 survey (Figure 45). The results of this exercise produced a heat map of vegetative cover in the lake over time where warmer colors (reds, yellows) indicate more dense plant cover and cooler colors (green) indicate less dense plant cover. The blue areas were mapped but were void of vegetation, the black areas were unmapped because they were too deep for plant growth.

Discussion and Management Recommendations

The water clarity of Lake Kegonsa has differential impacts among the various fish species within the lake. Therefore, the fisheries management direction of Lake Kegonsa is closely coupled with the water quality and clarity status of the lake. The current status is a eutrophic system which receives most of its nutrient load from the upper lakes in the Madison Chain. Given the relatively small watershed area (compared to upper Yahara watershed), the lake will stay in this state until major reductions in nutrient sources are addressed within the Lake Kegonsa basin and in upstream watersheds.

Angler Creel and Preferences Survey

Angler creel and preference surveys provide invaluable information to resource managers but are not included in WDNR baseline monitoring protocols or budgets. Angler creel surveys collect quantitative data on what species anglers target, how many they catch, how many they harvest, what gear they use, and how long they fish for. Angler preference surveys ask questions about angler expectations including what they most enjoy about fishing, what species they would like to harvest, what species they most often target, and how important certain aspects of recreational angling are to them (e.g., scenic beauty and serenity or catching a trophy-sized fish). These types of surveys are uncommon in the southern half of the state. Conducting more angler preference and creel surveys on southern lakes will improve management of local and statewide fisheries by providing additional context for southern waters. However, to complete these surveys, additional funding is needed to hire staff and implement the surveys. Comprehensive angler creel and preference surveys on Lake Kegonsa for all major game and panfish species remains a high priority because they would provide more relevant information to inform future management decisions.

Walleye Management in Lake Kegonsa

There was evidence of limited walleye natural reproduction in Lake Kegonsa (i.e. fish in the $\leq 6-9''$, Figure 2) but recruitment was variable. In the last thirteen years, seven years have produced estimates above the 10 YOY per mile benchmark and the two highest abundance years were recorded in 2014 and 2016 (Figure 5). These YOY recruits are assumed to be a combination of natural reproduction, stocked fish, and immigration from upstream lakes.

Understanding the contributions of stocked vs naturally reproduced walleye in Kegonsa remains a high management priority. Oxytetracycline marking studies in the Madison Chain in the 1990's showed significant contributions of stocked small fingerling walleyes to the overall population. Recent supplemental large fingerling stocking events have apparently not contributed to the population, based on available evidence. If sufficient funding is allocated in 2019, WDNR will sample age-one walleyes to compare the genetics of these fish to the known-genetics of adult brood stock used in hatcheries. This information will further elucidate the contribution of stocked vs naturally reproducing walleyes in Lake Kegonsa. It is important to note that stocking in a system where natural reproduction occurs can suppress the contribution of naturally reproduced fish. To fully understand the proportion of stocked vs naturally reproduced walleye, we would need to discontinue stocking efforts for multiple years in the Chain and assess the numbers of YOY observed in the fall recruitment electrofishing surveys.

Though the adult walleye population spawned several successful year-classes, we saw no evidence that more stocking equated to more walleye recruits. Rather, recruitment was likely limited by other physical and environmental variables. There are at least two issues that limit natural reproduction and recruitment in Lake Kegonsa: first and foremost, Lake Kegonsa lacks the preferred spawning habitat in the form of complex, expansive rock and boulder substrates within the littoral zone. The existing habitats have been compromised by development and subsequent sedimentation. If spawning habitat were adequate, we would expect the fish to spawn successful year-classes on a regular basis that would be detected in our annual monitoring surveys (Figure 5). Adding habitat complexity with additional wood (tree drops and fish stick habitat projects) may improve recruitment success by offering young fish nursery refugia. However, the preferred walleye spawning habitat is expansive, tightly packed cobble with small interstitial spaces where fertilized eggs and young fish can survive the earliest stages of egg

and YOY development through fry swim-up. Artificial rock reefs for spawning substrate have had mixed results in other parts of the state and are likely not a good fit for Kegonsa given the high percentage of private shoreline ownership and heavy recreational boating use. The Yahara river including the tailwaters of Babcock Dam, and rocky, scoured areas do offer some limited spawning habitat for walleye. Secondly, the young walleye that do hatch and reach the pelagic phase are beneficiaries of turbid water which aids them in avoiding predation, but they need prey resources that closely align to when they enter this phase. The timing and abundance of zooplankton may be changing due to climate change and invasive species, but further research is needed. Variable spring weather and precipitation events, ice cover duration, and temperatures alter the timing of when walleyes spawn, fry emerge, enter the pelagic phase, and can be decoupled from when prey is available. This phenomenon is well-documented in other species (terrestrial and aquatic) and is an area of research interest for walleye recruitment dynamics in Wisconsin. Additionally, zooplankton abundance is threatened by spiny waterfleas, a relatively new invasive species that preferentially feed on native daphnia. WDNR and University of Madison researchers are collaborating to better understand this dynamic but further research is needed.

To help improve the fishery of Kegonsa, fishing clubs and conservation groups could direct their efforts and capital into habitat improvement projects including fish sticks, tree drops, and support efforts to increase riparian vegetation buffers and woody habitat along privately-owned shorelines within the watershed and its tributaries. This could be a simple conversation with riparian landowners and neighbors about allowing a downed tree to remain for fish habitat or active outreach or a coordinated community effort with WDNR to place fish sticks/ tree drops in appropriate areas within the littoral zone of the lake or tributaries. These efforts would increase survival of stocked or naturally reproduced fish avoid predation and forage efficiently.

Evidence of Growth-Overfishing of Walleye

Growth-overfishing occurs when angler harvest removes fish in high enough rates to cause a decrease in the size-structure of the population. Walleye above the legal limit of 15" were harvested from the system and was evidenced by a sharp decline in the number of larger fish in the system (Figure 1). Another decline in the age structure was apparent at age 4 when walleye became legal size for harvest (Figure 6 & 9) resulting in a total annual mortality estimate of forty-two percent. Lastly, growth rates of legal sized fish between the ages of five and six were depressed (Figure 7) suggesting anglers were removing the fastest growing fish in the population as they became legal size. The walleye population estimate of less than two fish per acre is on the lower end of what is tenable given the size, productivity, and stocking rates in Kegonsa but is on par with high angling pressure lakes in southern Wisconsin. Reversing these trends will require strong local, public support favoring a higher population but delayed harvest opportunities. Specifically, moving towards managing walleye with a more restrictive size and bag limit (i.e. 18" minimum size limit, 3 daily bag limit) would increase the catch rates of walleye by increasing the number of fish in the lake; therefore, moving Lake Kegonsa from an average walleye fishery towards an above average fishery in terms of size structure and abundance. However, if the current management system is preferred by anglers, no further action is needed.

Walleye Management Objectives:

- 1) Current management goal is to provide a harvest-oriented fishery
- 2) Maintain YOY walleye recruitment of >10 per mile over a three-year average

- a. Monitored by WDNR staff during fall electrofishing surveys
 - b. Identify source of walleye recruitment, and contribution of stocked fish
- 3) Maintain/ increase walleye adult population of 3 fish per acre
 - a. Increasing the population to 3 fish per acre is the management objective given the current regulation regime but could be increased further with delaying angler harvest until they reach larger sizes through more restrictive size and bag limits.
- 4) Assess stakeholder interest in managing walleye population for Quality opportunities versus current harvest-oriented fishery through potential regulation changes (e.g. 18" length minimum, 3 daily bag limit).

Northern Pike Management in Lake Kegonsa

Northern pike in Lake Kegonsa exhibited excellent growth rates (Figure 13-14), regular recruitment (Figure 12), and consistent age structure (Figure 17) but abundance was lower than desired, and we would like to see increases in recruitment. Since northern pike use shallow aquatic vegetation to spawn on, we expect to observe improvements in the northern pike population with improved water quality and aquatic plant growth, providing additional recruits through natural reproduction. The Door Creek area is the only major tributary and is largely unsuitable for pike spawning; the substrate is dominated by soft sediment, lacks aquatic vegetation for pike eggs to adhere to, and the ditch network is disconnected from the floodplain, preventing adult access. Increasing and promoting access to higher quality, restored and reconnected wetlands within Door Creek, the tributary near Kegonsa State Park, Upper Mud Lake, and the ditches within Barber's Bay would provide adult pike additional spawning grounds and nursery areas for their offspring.

Evidence of Growth-Overfishing of Northern Pike

Similar to walleyes, growth-overfishing was apparent in the northern pike population. There was evidence of slower growth rates at the legal length limit (Figure 13), reduced growth rates (Figure 14), and a steep decline in the number of four-year-old vs three-year-old fish (Figure 17). These effects to the population could be offset with increased recruitment or delayed with fishing regulation modifications.

The northern pike population estimate was a modest 2095 fish (0.65 per acre) but given the productivity of the system, could likely be increased to at least 1.5 per acre. The northern pike growth potential in Lake Kegonsa is excellent, and the lake is capable of producing trophies, but these fish were rare given the harvest pressure and current regulation. Northern pike age structure should be improved to include a higher proportion of age four and older fish, which will improve size structure to include more fish over the legal limit of 26". However, these objectives could be met more effectively, and with more certainty, through regulation modifications, such as a 32" minimum length limit, 1 daily bag limit. With any regulation change proposal, strong public and local support is needed to move forward.

Northern Pike Management Objectives:

- 1) Current management goal is to provide a Quality fishing opportunity with increased size structure
- 2) Improve northern pike population to 1.5 per acre
- 3) Identify nursery areas and relative abundance of YOY pike produced
 - a. Identify contribution and sources of naturally reproduced vs stocked fish

- 4) Increase size structure to include more fish above the legal limit from current 28% to 35% (33% in 2001).
- 5) Assess stakeholder interest in managing for trophy potential vs current quality fishery.

Panfish Management in Lake Kegonsa

Bluegill abundances during SE2 surveys in Lake Kegonsa were very low (Figure 22) but closer examination of the age structure (Figure 24) indicated stable year-class formation/recruitment success. The size structure was good with fish in the 6-10" range (Figure 20) and bluegills grew very fast in Kegonsa (Figure 21). The abundance of 3", 6", and 8" fish had been much higher in recent surveys (2005) but had since declined, presumably as water quality and habitat has diminished. Given the high abundance of age-2 fish in the survey (Figure 24), Kegonsa may experience increased Bluegill abundance in 2017 and beyond as those fish enter the fishery; possibly as a result of improved water clarity and increased aquatic plants (Figure 45), but future surveys and continued monitoring are needed to better understand any correlations or mechanisms.

Like bluegills, black crappies had good growth rates (Figure 28) and acceptable size structure (Figure 27) dominated by year-classes that produced five and six-year-olds in 2016 (Figure 31). Black crappies demonstrated a bimodal distribution with many young fish and many older fish currently in the system, but few middle aged/sized fish (Figure 27). This is typical of variable recruitment species like crappies but the current catch rate of 1.73 per night net was well below the median rate of 8.05 per net night. We sampled so few yellow perch in our 2016 survey (Figure 44), we are unable to make recommendations or robust inferences regarding the status of that fishery.

Bluegills and black crappies (presumably yellow perch too) had generally lower than expected abundance which was closely related to lower water quality, low aquatic plant abundance, and generally sparse habitat in the lake. These fish species are sight-feeders and the low water clarity reduces their foraging and capture efficiency while diminishing their ability to detect predators. The lack of aquatic plants exposes all size classes of fish, young and old, to increased predation pressures. Increased plant growth will allow young panfish like bluegills, crappies, and yellow perch more places to hide from predators, and adult fish safer places to forage, resulting in stronger year-classes and better fishing opportunities for anglers. Increased woody cover in the form of tree drops or fish-sticks structures would give panfish additional places to hide, forage, and grow. Yellow perch and Black Crappies would also benefit from these types of structures as they seek out submerged wood, logs and structures to spawn on and around while giving anglers areas to target.

One caveat to our early ice-off spring netting (SN1) and electrofishing (EF1) methods is that these gears don't always adequately sample the panfish populations based on how the spring thaw occurs. If we have quick warmup and rapid ice-off, the walleyes and northern pike will be spawning quickly and for a short duration, but the panfish and bass will still be off-shore and weeks away from spawning. In these years, we often deploy a second round of netting operations in late spring to specifically target panfish or rely on an additional targeted netting effort (SN2) to sample these populations. However, this was not possible in 2016 for Lake Kegonsa bass/panfish due to timing of the spring thaw and WDNR staffing limitations. Therefore, acquiring adequate sample sizes and size demographics can be challenging in some years. This appears to be the case in 2016 for black crappies and yellow perch, but we did capture the general demographics of the fishery. We do know that Lake Kegonsa can offer limited, but excellent fishing opportunities for larger bluegills and yellow perch when anglers can find them. We heard angler anecdotes and reports of large bluegill and a good yellow perch fishery in winter of 2017 that we did not

detect as strongly in our survey efforts. The commercial carp seiners also reported large bluegills as bycatch in their seining operations (these fish were released unharmed).

Panfish Management Objectives:

- 1) Current management goal is to provide a harvest-oriented fishery
- 2) Increase bluegill electrofishing catch rates to 86 per mile (median value for similar lakes)
 - a. Improving habitat should increase recruitment
- 3) Increase black crappies fyke net catch rates to 8.05 per net night (median value of similar lakes)

Largemouth and Smallmouth Bass Management in Lake Kegonsa

Large and smallmouth bass are intermediate predators with important roles in structuring a healthy fish population and popular targets among anglers. Age demographics revealed variable year-class formation (weak age-3 and age-4 class, Figure 36) but the overall size structure of largemouth bass was good (Figure 32). However, the catch rate was low (5.0 per mile) compared to surveys conducted in the early 2000's (Figure 35). Low abundances were also apparent when compared to contemporary data from other lakes (Figure 34). The low abundance since 2008 is somewhat surprising given high catch and release rates among anglers, and bass populations typically exhibit stable populations. The recent decline is likely part of a long-term trend of declining water quality and reduced habitat in the form of woody habitat. In addition to historically low aquatic plant biomass (but improving), as land-use changes and shoreline development encroaches into the water-land interface, fish habitat in the form of naturally fallen trees and aquatic plants have become rare within the littoral zone. Replacing and mimicking these habitat features along private shorelines would improve the bass fishery by providing fish places to seek cover, create nest sites, forage more efficiently, and give anglers locations to target.

Though the 2016 sample size was modest, the catch rates of smallmouth bass were among the highest among lakes similar to Kegonsa (Figure 42) but this is an artifact of recent increases in a population that had otherwise remained low and stable over the previous decade (Figure 41). The observed increases in smallmouth bass abundance and catch rates are especially interesting in the context of declining largemouth populations. Determining any potential ecological mechanisms that would promote smallmouth bass populations over largemouth bass is beyond the scope of this report and our monitoring protocols but warrants future attention. The comprehensive survey scheduled for 2022 will replicate the 2016 effort for continued monitoring and compute a population estimate for both species of bass for added context.

Largemouth and Smallmouth Bass Management Objectives

- 1) Current management goal is to provide a Quality fishing opportunity with increased size structure
- 2) Increase abundances of largemouth bass measured as improved electrofishing catch rates to meet or exceed 14.5 per mile (median value for lakes similar to Kegonsa).
- 3) Improve size structure of LMB using size specific CPUE
- 4) Maintain smallmouth bass electrofishing catch rates of 10-15 per mile
 - a. Increase the catch rates of Preferred (14") and Memorable (17") sizes

These are achievable goals if habitat and water quality improvements continue and are prioritized. Regulation changes are not recommended for consideration for either species of bass given the current size and age data showed no signs of growth overfishing and stable populations.

Carp removals and aquatic vegetation

We've documented an increase in the aquatic plant community cover in recent years, likely due to mechanical removal of carp and the koi herpes outbreak of 2017. Therefore, we strongly support current and future removal efforts and finding ways to reduce the carp population at or below the 100 – 150 pounds per acre threshold. WDNR continues to monitor fish population metrics on a 5-year rotation schedule (Kegonsa 2022 survey planned) and annually monitors the aquatic plant response with BioBase™ sonar surveys. Common carp have long been an established aquatic invasive species in Wisconsin. Their feeding behavior uproots native vegetation and resuspends nutrient rich sediments, resulting in poor water quality and exacerbating blue-green algae blooms. WDNR, Friends of Lake Kegonsa, and Dane County have partnered to reduce the carp population to less than 100lbs per acre in biomass to improve the water quality and fishery of Lake Kegonsa. 100 lbs. per acre of carp biomass has been shown to be the tipping point where carp no longer have serious detrimental impacts to the water quality or fisheries of the lake, and aquatic plant species can remain dominant. Below 100lbs per acre allows desirable gamefish/panfish species and aquatic plants to thrive with lower carp biomass resulting in better water quality. Carp removal contracts are reviewed and offered annually on selected waterbodies including Lake Kegonsa for 2019 and 2020.

A difficult metric to calculate has been a robust population estimate for common carp. Comparing the population estimate with total annual biomass production would be a valuable tool in computing a more accurate estimate of the percentage of the carp population removed each year, what percentage is replaced via natural reproduction and how much immigration occurs. These metrics are difficult to compute but would provide a better estimate of how many carp need to be removed and at what interval. A population estimate using standard WDNR gear is less reliable because our gear is not designed for carp nor does the timing of our sampling program align well with when they are most vulnerable (spawning in early June typically). Novel trapping methods specifically designed for attracting and removing common carp (e.g. baited trap nets) could be considered if funding allowed and the local public supported such efforts. We will continue to offer annual carp removal contracts to commercial fishers so long as there is a demonstrated need, public support, and demonstrated positive fishery, aquatic plant, and/or water quality response. Nonetheless, it is encouraging that we are seeing aquatic plant responses to our commercial carp removal efforts.

Aquatic vegetation

Aquatic vegetation plays an important role in any healthy fishery; providing cover from predators, attracting organisms for fish to feed on, and giving fish a place to actively forage and hide with minimal effort. Maintaining a diversity of aquatic vegetation is critical to maintaining a healthy balance of aquatic insects, fish habitats, and will have positive, cascading impacts for fisheries and anthropogenic interests including wave attenuation, phosphorus sequestration, and sediment control. Removing nuisance and excessive aquatic vegetation, especially Eurasian milfoil, has been a routine practice to improve recreational opportunities and as a flood mitigation tool. These efforts are a collaborative effort between WDNR and Dane County staff. The aquatic plants near the undeveloped shorelines at Fish Camp and Lake Kegonsa State park are not harvested. The rocky outcroppings near Lunds and Calladay Point pose a hazard to the cutting machines and are not harvested. The remainder of the shoreline is

considered cuttable for recreational and navigational purposes and is second in priority below flood mitigation efforts. Flood mitigation efforts occur within the Yahara River channel from Dyerson Road downstream to Fish Camp boat launch. WDNR is in routine communication with Dane County staff regarding harvesting timelines, amounts, and necessity and both groups are committed to minimizing angler/ harvesting conflicts to the maximum extent possible. We know that plant harvesting does collect fish as bycatch, but we have no data indicating plant removals are impacting fish communities at a population level. We continue to monitor harvesting schedules with emphasis on minimizing fish bycatch and angler conflicts, while monitoring population level trends over time for all major game and panfish species. More information on Dane County Aquatic Plant Management Plan can be found here: <https://wred-lwrd.countyofdane.com/Aquatic-Plant-Management>

Aquatic Invasive Species

Invasive species like zebra mussels and spiny water fleas are also changing the food web of the lake with unknown consequences to the fish community. Spiny water fleas displace native daphnia populations which are the preferred food for panfish and young gamefish. Zebra mussels have the potential to alter the food webs in dramatic ways by efficiently filtering the water and excreting nutrients into the bottom of the lake where it is less accessible to other organisms. We are continuing to monitor and evaluate the fish populations and collaborating with University of Wisconsin-Madison researchers to better understand the impacts these invasive species will have on the fishery within the Madison Chain of Lakes. Another management goal is to reduce Eurasian watermilfoil coverage and replace it with native plant species. It is important to disinfect boats and recreational gear prior to moving waterbodies to limit the spread of invasive species; see the WDNR's Clean Boats, Clean Waters program for additional details: <https://dnr.wi.gov/lakes/cbcw/>

Supplemental Material

Requires Microsoft Excel™ software



Kegonsa_Summary_
Statistics_2001_2018

Table 1. Summary statistics for each gear (EF, electrofishing or fyke nets) and season (spring or fall) for Lake Kegonsa 2016 comprehensive fishery survey.

Lake	Year	Gear	Season	Species	# of Fish	Minimum Length Inches	Average Length Inches	Maximum Length Inches
Kegonsa	2016	EF	Fall	BLACK CRAPPIE	3	3.6	6.43	11
Kegonsa	2016	EF	Fall	BLUEGILL	10	3.7	5.81	10.1
Kegonsa	2016	EF	Fall	CARP	24			
Kegonsa	2016	EF	Fall	FRESHWATER DRUM	15			
Kegonsa	2016	EF	Fall	LARGEMOUTH BASS	18	3.2	8.07	16.2
Kegonsa	2016	EF	Fall	LOGPERCH	2	3.3	3.35	3.4
Kegonsa	2016	EF	Fall	MUSKELLUNGE	1	35.1	35.1	35.1
Kegonsa	2016	EF	Fall	NORTHERN PIKE	5	13.6	19	26.7
Kegonsa	2016	EF	Fall	PUMPKINSEED	3	4.7	6.07	7
Kegonsa	2016	EF	Fall	SMALLMOUTH BASS	7	9	12.39	16.9
Kegonsa	2016	EF	Fall	WALLEYE	596	5.8	11.03	23.4
Kegonsa	2016	EF	Fall	WHITE BASS	20	5.6	10.96	15
Kegonsa	2016	EF	Fall	WHITE SUCKER	6			
Kegonsa	2016	EF	Fall	YELLOW BASS	39	4.2	6.15	11.7
Kegonsa	2016	EF	Fall	YELLOW BULLHEAD	1	11.8	11.8	11.8
Kegonsa	2016	EF	Fall	YELLOW PERCH	4	3.7	3.83	4
Kegonsa	2016	EF	Spring	BLACK CRAPPIE	1	4.6	4.6	4.6
Kegonsa	2016	EF	Spring	BLUEGILL	1	8.1	8.1	8.1
Kegonsa	2016	EF	Spring	FRESHWATER DRUM	15			
Kegonsa	2016	EF	Spring	LARGEMOUTH BASS	22	7.2	14.58	18.2
Kegonsa	2016	EF	Spring	MUSKELLUNGE	1	38.3	38.3	38.3
Kegonsa	2016	EF	Spring	NORTHERN PIKE	32	8.9	24.81	38.1
Kegonsa	2016	EF	Spring	NORTHERN PIKE X				
Kegonsa	2016	EF	Spring	MUSKELLUNGE	1	38.1	38.1	38.1
Kegonsa	2016	EF	Spring	SMALLMOUTH BASS	21	8.1	12.6	15.9
Kegonsa	2016	EF	Spring	WALLEYE	173	6	12.02	25.9
Kegonsa	2016	EF	Spring	WHITE BASS	2	12.6	13.45	14.3
Kegonsa	2016	EF	Spring	YELLOW BASS	6	8.1	10.73	11.6

				YELLOW				
Kegonsa	2016	EF	Spring	BULLHEAD	1	10.8	10.8	10.8
Kegonsa	2016	FYKE	Spring	BLUEGILL	1563	3.4	6.44	10.2
Kegonsa	2016	FYKE	Spring	YELLOW BASS	862	3.3	7	12.3
Kegonsa	2016	FYKE	Spring	WALLEYE	509	7.4	15.92	28.3
Kegonsa	2016	FYKE	Spring	BLACK CRAPPIE	423	3.2	8.15	12.2
Kegonsa	2016	FYKE	Spring	WHITE BASS	414	4.6	13.08	15.7
				NORTHERN				
Kegonsa	2016	FYKE	Spring	PIKE	322	9.2	23.99	40.3
				YELLOW				
Kegonsa	2016	FYKE	Spring	BULLHEAD	171	4.7	11.75	15
				LARGEMOUTH				
Kegonsa	2016	FYKE	Spring	BASS	60	5.1	12.34	19.7
Kegonsa	2016	FYKE	Spring	PUMPKINSEED	36	3.5	5.61	7.2
Kegonsa	2016	FYKE	Spring	WHITE SUCKER	25	16.4	20.12	23.2
				GOLDEN				
Kegonsa	2016	FYKE	Spring	SHINER	24			
				SMALLMOUTH				
Kegonsa	2016	FYKE	Spring	BASS	21	7.8	12.61	15.3
				COMMON				
Kegonsa	2016	FYKE	Spring	CARP	19	5.2	9.36	23.6
Kegonsa	2016	FYKE	Spring	YELLOW PERCH	15	5.7	8.36	11.5
Kegonsa	2016	FYKE	Spring	MUSKELLUNGE	14	24.9	36.39	44.5
				BROWN				
Kegonsa	2016	FYKE	Spring	BULLHEAD	11	5.2	10.16	14.6
				FRESHWATER				
Kegonsa	2016	FYKE	Spring	DRUM	10			
				WHITE				
Kegonsa	2016	FYKE	Spring	CRAPPIE	8	3.9	5.38	10.7
Kegonsa	2016	FYKE	Spring	BOWFIN	7			
Kegonsa	2016	FYKE	Spring	ROCK BASS	5	7.5	7.85	8.2
				BLACK				
Kegonsa	2016	FYKE	Spring	BULLHEAD	4	6.5	7.65	8.9
Kegonsa	2016	FYKE	Spring	WARMOUTH	4	5.7	5.75	5.8
Kegonsa	2016	FYKE	Spring	BULLHEADS	3			
				GREEN				
Kegonsa	2016	FYKE	Spring	SUNFISH	3	3.9	5.63	6.9

Table 2. Wisconsin Department of Natural Resource (WDNR) and Stoughton Conservation Club (SCC) stocking summary for Lake Kegonsa 2010-2017.

Year	Lake	Source	Species	Strain	Age Class	Number Stocked	Average Length Inches
2010	Kegonsa	WDNR	N. Pike	Madison Chain of Lakes	Large Fingerling	2500	7.5
2011	Kegonsa	WDNR	N. Pike	Madison Chain of Lakes	Small Fingerling	2500	2.65
2012	Kegonsa	WDNR	N. Pike	Madison Chain of Lakes	Large Fingerling	2800	7.9
2013	Kegonsa	WDNR	N. Pike	Madison Chain of Lakes	Large Fingerling	1973	7.5
2014	Kegonsa	WDNR	N. Pike	Madison Chain of Lakes	Large Fingerling	2500	8.8
2015	Kegonsa	WDNR	N. Pike	Madison Chain of Lakes	Large Fingerling	2077	8.3
2016	Kegonsa	WDNR	N. Pike	Madison Chain of Lakes	Large Fingerling	2500	8
2016	Kegonsa	WDNR	N. Pike	Madison Chain of Lakes	Small Fingerling	16000	1.94
2017	Kegonsa	WDNR	N. Pike	Madison Chain of Lakes	Large Fingerling	2248	8.4
2010	Kegonsa	SCC	Walleye	Rock-Fox	Large Fingerling	1500	7.5
2010	Kegonsa	WDNR	Walleye	Rock-Fox	Small Fingerling	112315	1.48
2011	Kegonsa	SCC	Walleye	Rock-Fox	Large Fingerling	4200	7
2011	Kegonsa	WDNR	Walleye	Rock-Fox	Small Fingerling	56000	1.48
2012	Kegonsa	SCC	Walleye	Rock-Fox	Large Fingerling	5500	7
2012	Kegonsa	WDNR	Walleye	Rock-Fox	Small Fingerling	54243	2.5
2013	Kegonsa	SCC	Walleye	Rock-Fox	Large Fingerling	6000	7
2013	Kegonsa	WDNR	Walleye	Rock-Fox	Small Fingerling	56000	1.4
2014	Kegonsa	SCC	Walleye	Rock-Fox	Large Fingerling	5454	7

2014	Kegonsa	WDNR	Walleye	Rock-Fox	Small Fingerling	57797	1.5
2015	Kegonsa	SCC	Walleye	Rock-Fox	Large Fingerling	5700	8
2015	Kegonsa	WDNR	Walleye	Rock-Fox	Small Fingerling	112016	1.6
2017	Kegonsa	WDNR	Walleye	Rock-Fox	Small Fingerling	112101	1.27
2018	Kegonsa	SCC	Walleye	Rock-Fox	Large Fingerling	8000	7

Table 3. Size-specific catch summary for selected game and panfish species in Lake Kegonsa during 2016 comprehensive survey. Effort is electrofishing miles for all Boom Shocker surveys and number of net nights for all Fyke netting surveys. See Appendix Table 1 for length categories associated with Stock, Quality, Preferred, Memorable, and Trophy sizes for each species. (EF indicates electrofishing survey with boom shocker boat).

Species	Gear	Season	Survey Type	N	Average Length (inches)	sd	se	Min length (inches)	Median length (inches)	Maximum length (inches)	Effort	Stock CPE	Quality CPE	Preferred CPE	Memorable CPE	Trophy CPE	Total CPUE
Bluegill	EF	Fall	FE	10	5.81	2.29	0.72	3.70	4.90	10.10	1.00	10.00	3.00	2.00	1.00	0.00	10.00
Bluegill	EF	Spring	SE2	1	8.10	NA	NA	8.10	8.10	8.10	1.00	1.00	1.00	1.00	0.00	0.00	1.00
Y. Perch	EF	Fall	FE	4	3.83	0.13	0.06	3.70	3.80	4.00	1.00	0.00	0.00	0.00	0.00	0.00	4.00
Blk. Crappie	EF	Fall	FE	3	6.43	3.99	2.31	3.60	4.70	11.00	1.00	1.00	1.00	1.00	0.00	0.00	3.00
Blk. Crappie	EF	Spring	SE2	1	4.60	NA	NA	4.60	4.60	4.60	1.00	0.00	0.00	0.00	0.00	0.00	1.00
Pumpkinseed	EF	Fall	FE	3	6.07	1.21	0.70	4.70	6.50	7.00	1.00	3.00	2.00	0.00	0.00	0.00	3.00
Largemouth Bass	EF	Fall	FE	18	8.07	3.59	0.85	3.20	8.25	16.20	4.00	2.50	0.50	0.50	0.00	0.00	4.50
Largemouth Bass	EF	Spring	SE1	19	14.72	2.18	0.50	7.20	15.20	18.20	11.71	1.54	1.54	0.85	0.00	0.00	1.62
Largemouth Bass	EF	Spring	SE2	3	13.73	0.42	0.24	13.40	13.60	14.20	4.00	0.75	0.75	0.00	0.00	0.00	0.75
Smallmouth Bass	EF	Fall	FE	7	12.39	2.51	0.95	9.00	12.20	16.90	4.00	1.75	1.25	0.25	0.00	0.00	1.75
Smallmouth Bass	EF	Spring	SE1	10	14.51	0.87	0.28	13.20	14.40	15.90	11.71	0.85	0.85	0.68	0.00	0.00	0.85
Smallmouth Bass	EF	Spring	SE2	11	10.86	2.18	0.66	8.10	10.80	14.10	4.00	2.75	1.25	0.25	0.00	0.00	2.75
Walleye	EF	Fall	FE	596	11.03	3.40	0.14	5.80	11.45	23.40	11.48	27.26	7.06	0.26	0.00	0.00	51.92
Walleye	EF	Spring	SE1	143	12.18	4.23	0.35	6.00	13.20	25.90	11.71	7.26	3.50	0.34	0.09	0.00	12.21
Walleye	EF	Spring	SE2	30	11.21	4.32	0.79	6.70	8.95	25.10	4.00	3.50	0.75	0.25	0.25	0.00	7.50

Table 3
(continued)

N. Pike	EF	Fall	FE	5	19.00	5.48	2.45	13.60	20.00	26.70	4.00	0.75	0.25	0.00	0.00	0.00	1.25
N. Pike	EF	Spring	SE1	28	25.44	6.61	1.25	14.20	24.50	38.10	11.71	2.39	1.79	0.68	0.34	0.00	2.39
N. Pike	EF	Spring	SE2	4	20.43	8.13	4.06	8.90	22.40	28.00	4.00	0.75	0.75	0.25	0.00	0.00	1.00
Muskellunge	EF	Fall	FE	1	35.10	NA	NA	35.10	35.10	35.10	18.96	0.05	0.05	0.00	0.00	0.00	0.05
Muskellunge	EF	Spring	SE1	1	38.30	NA	NA	38.30	38.30	38.30	11.71	0.09	0.09	0.09	0.00	0.00	0.09
Bluegill	Fyke	Spring	SN1	1563	6.44	1.63	0.04	3.40	6.00	10.20	244.00	4.63	2.39	1.12	0.05	0.00	6.41
Y. Perch	Fyke	Spring	SN1	15	8.36	1.75	0.45	5.70	7.90	11.50	244.00	0.06	0.03	0.01	0.00	0.00	0.06
Blk. Crappie	Fyke	Spring	SN1	423	8.15	3.16	0.15	3.20	9.80	12.20	244.00	1.03	0.93	0.79	0.02	0.00	1.73
Pumpkinseed	Fyke	Spring	SN1	36	5.61	1.09	0.18	3.50	5.40	7.20	244.00	0.13	0.06	0.00	0.00	0.00	0.15
Largemouth Bass	Fyke	Spring	SN1	60	12.34	4.19	0.54	5.10	14.05	19.70	244.00	0.18	0.14	0.09	0.00	0.00	0.25
Smallmouth Bass	Fyke	Spring	SN1	21	12.61	2.19	0.48	7.80	13.30	15.30	244.00	0.09	0.07	0.03	0.00	0.00	0.09
Walleye	Fyke	Spring	SN1	509	15.92	3.03	0.13	7.40	15.30	28.30	244.00	2.04	1.23	0.16	0.05	0.00	2.09
N. Pike	Fyke	Spring	SN1	322	23.99	6.24	0.35	9.20	23.50	40.30	244.00	1.22	1.01	0.25	0.11	0.01	1.32
Muskellunge	Fyke	Spring	SN1	14	36.39	5.33	1.43	24.90	36.80	44.50	244.00	0.05	0.04	0.02	0.01	0.00	0.06

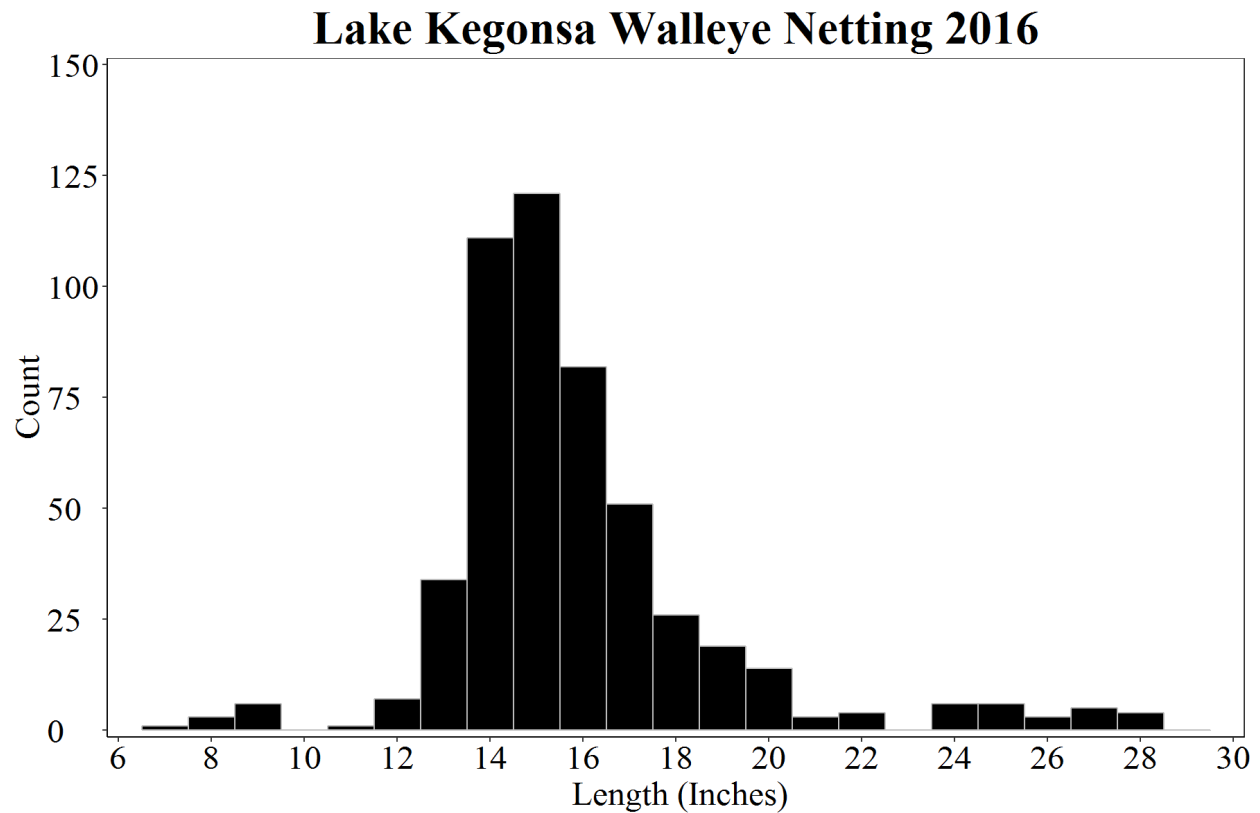


Figure 1. Lake Kegonsa walleye length-frequency histogram from netting survey conducted on March 13 through April 14, 2016. Note the generally normal distribution of the sample, with evidence of harvest influence depicted as a decline in the number of fish greater than 15". However, some larger fish 22-30" remain in the fishery providing trophy opportunities.

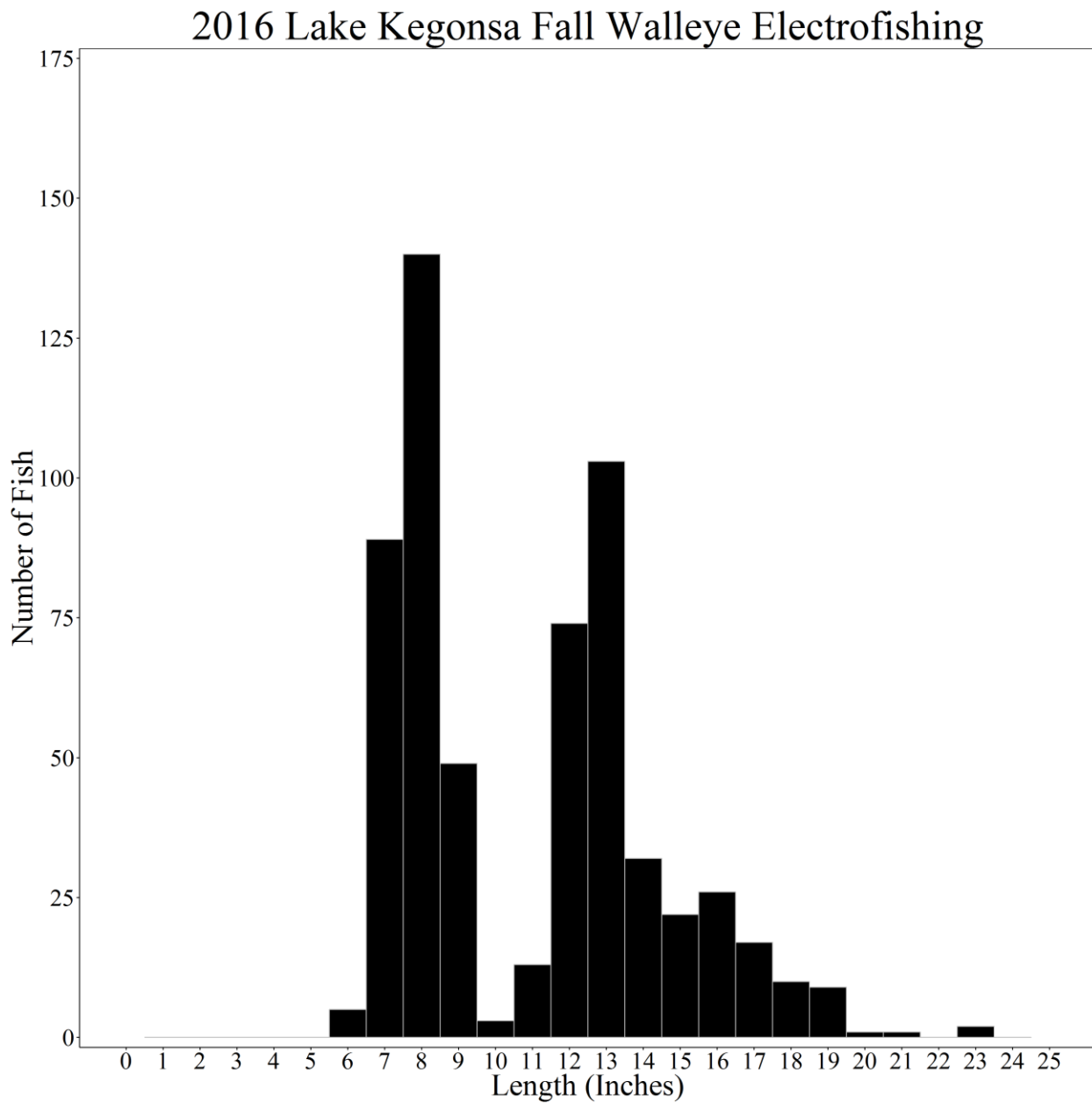


Figure 2. Lake Kegonsa fall Walleye recruitment electrofishing survey conducted on 9-27-2016. Walleye in the 6-9" range are the 2016-year class of Young of the Year or Age 0. These are likely a combination of hatchery stocked fish, migrating fish from Lake Waubesa and natural reproduction.

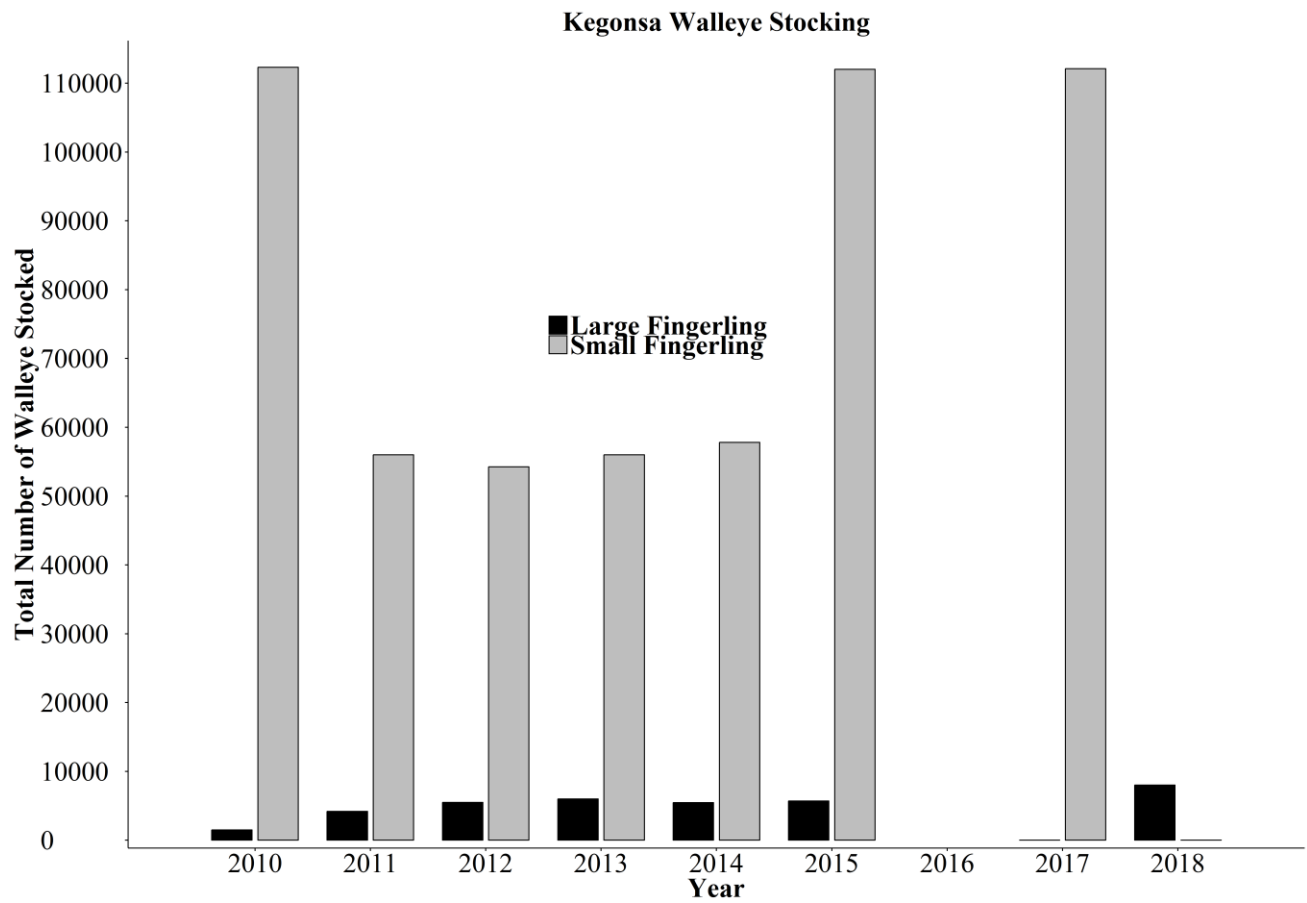


Figure 3. Walleye Stocking efforts in Lake Kegonsa by the Wisconsin Department of Natural resources (light bars) and Stoughton Conservation Club (dark bars).

Lake Kegonsa Walleye-Fall EF

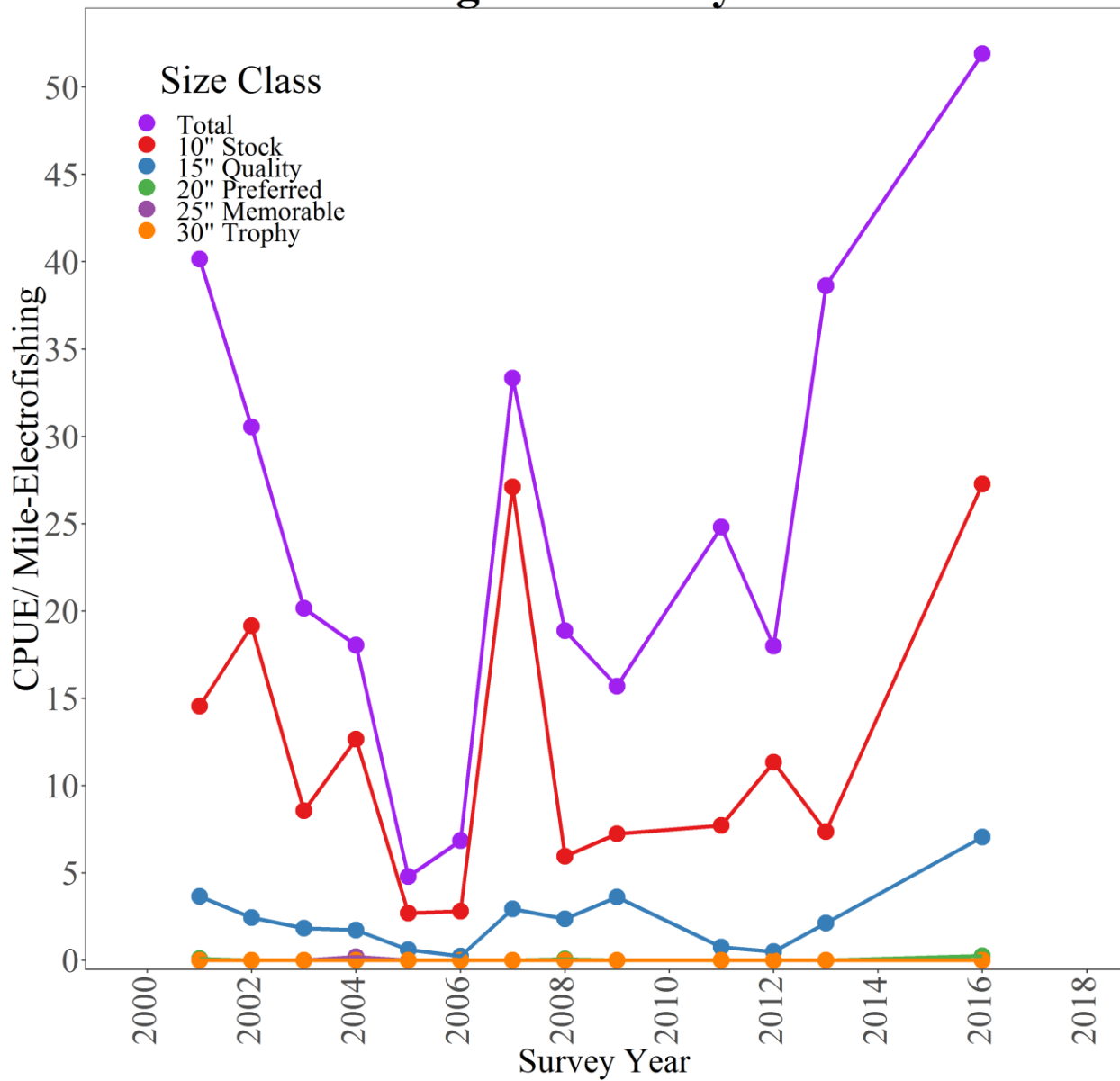


Figure 4. Size-specific catch rates for Lake Kegonsa Walleye 2001-2016. The influx of small fingerling walleye (112,016) in 2015 are recruiting to the fishery and are available to anglers.

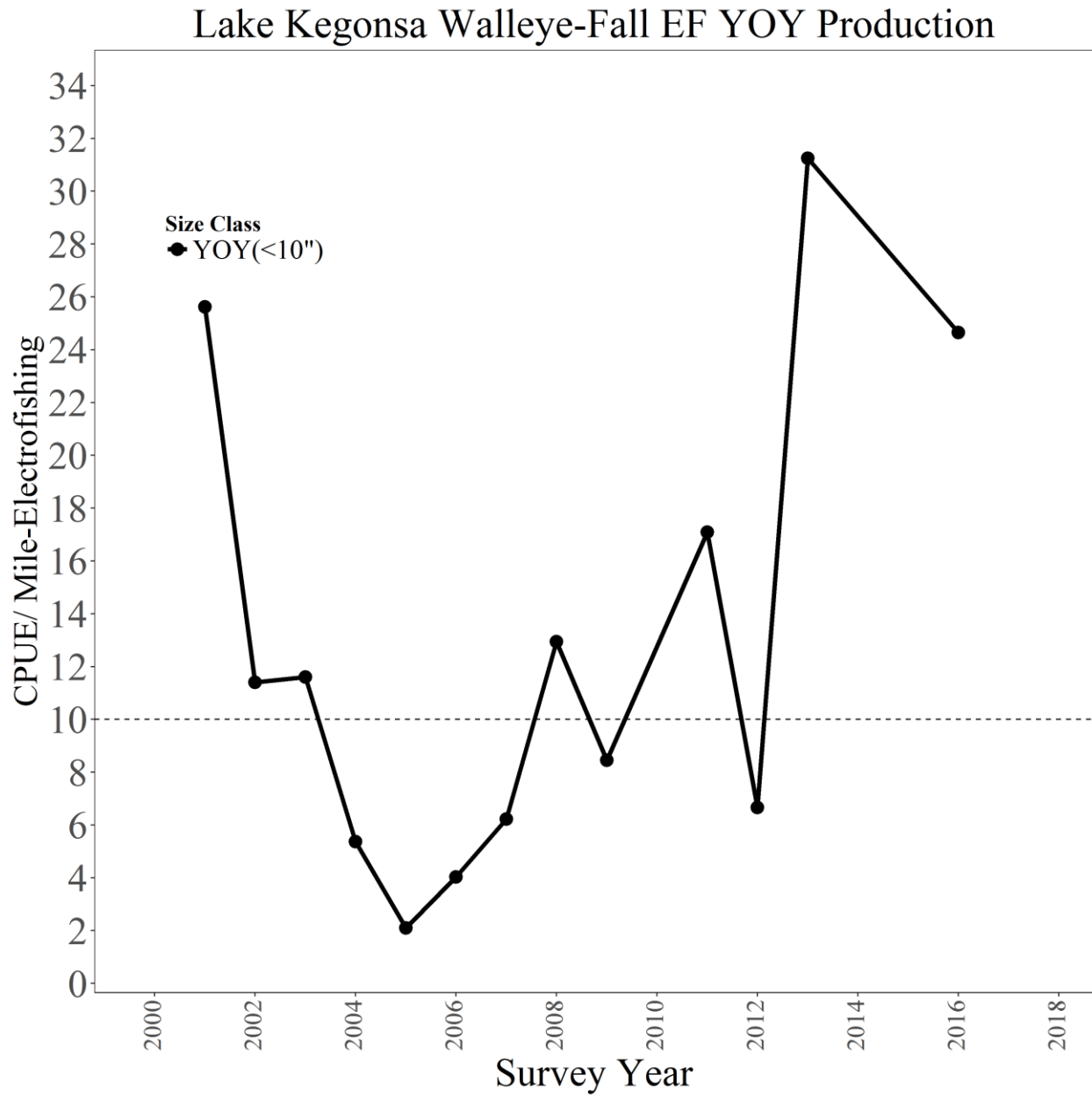


Figure 5. Walleye young-of-year catch rates 2001-2017 (solid lines and points) with the minimum 10 YOY per mile required for a successful year-class benchmark highlighted (dotted line).

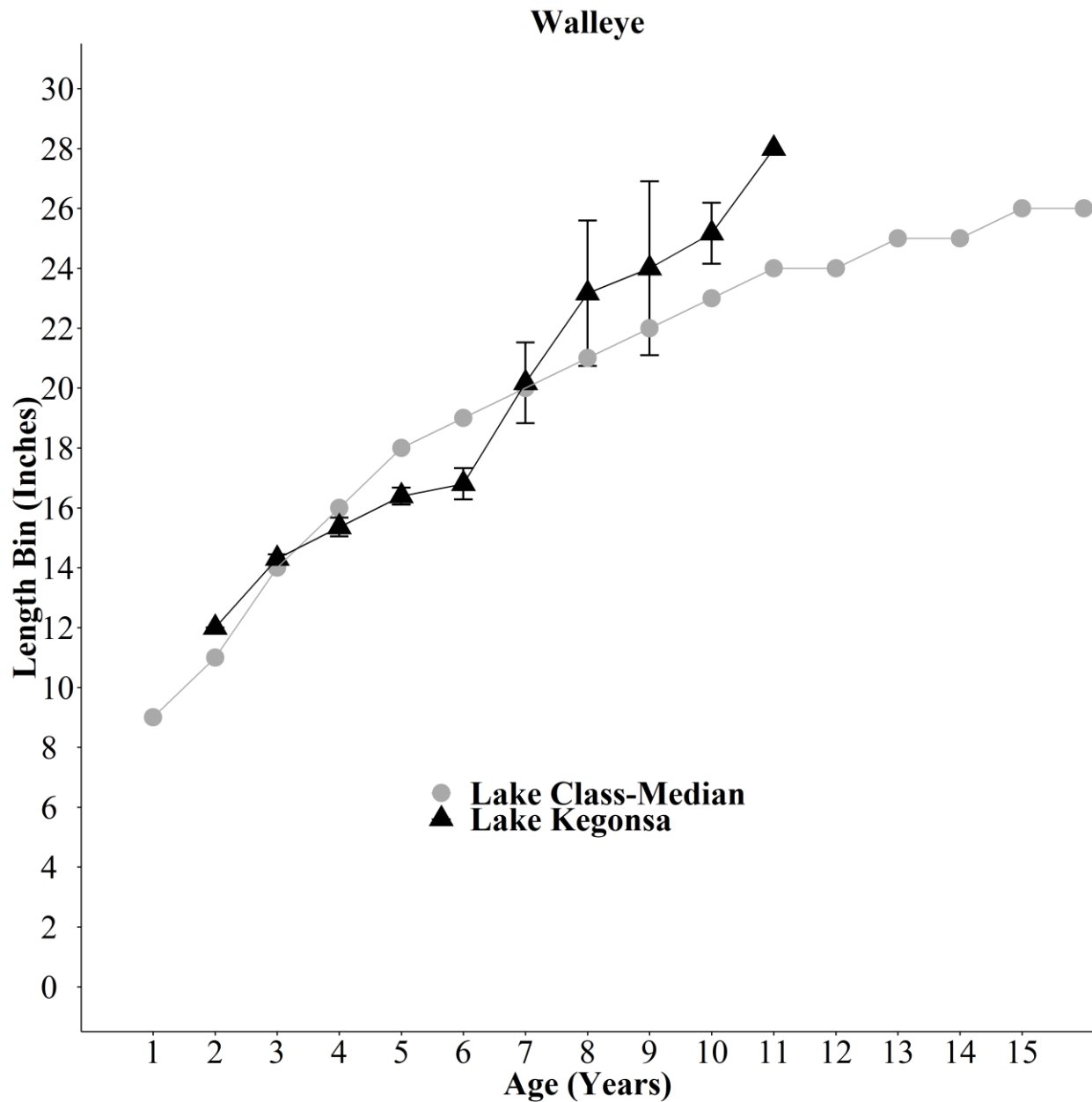


Figure 6. Length-at-age demographics for Walleye collected from spring survey conducted on March 13 through April 14, 2016. Lake Kegonsa walleye ages were estimated using sectioned and polished anal fin rays (dark triangles) and compared to 199 lakes similar to Lake Kegonsa (light circles). Walleye in Lake Kegonsa grow faster and reach longer sizes than their cohorts from similar lakes. Error bars represent 95% confidence intervals around the mean length for given age.

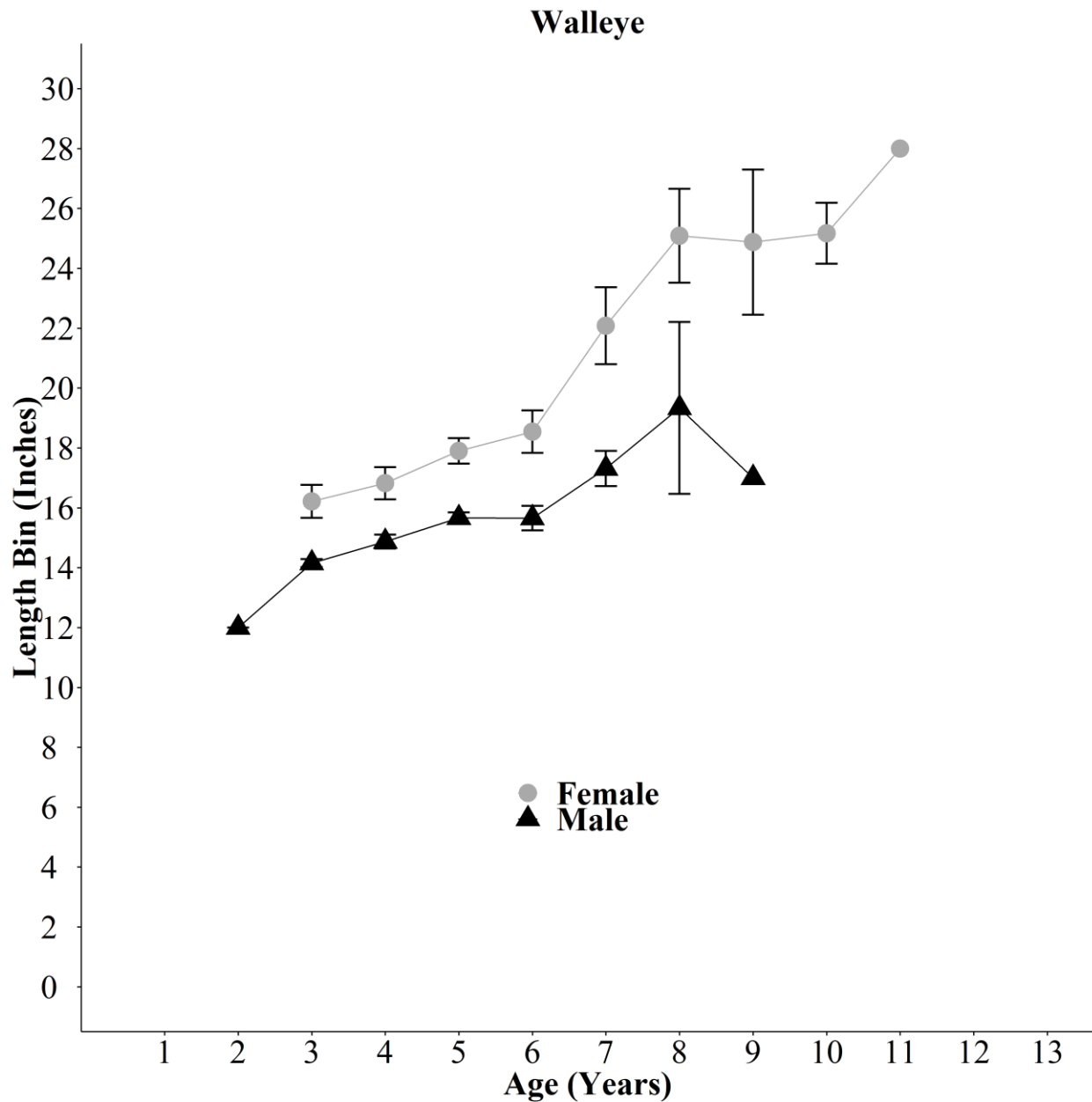


Figure 7. Length-at-age demographics for male and female Walleye collected from spring survey conducted on March 13 through April 14, 2016. Female Walleye (grey circles) in Lake Kegonsa grow faster and reach longer sizes than males (filled triangles). For example, a 6-year-old male is approximately 16" compared to 19" for a female of the same age. The divergent growth trajectories between males and females is more pronounced at older ages. Error bars represent 95% confidence intervals around the mean length for given age.

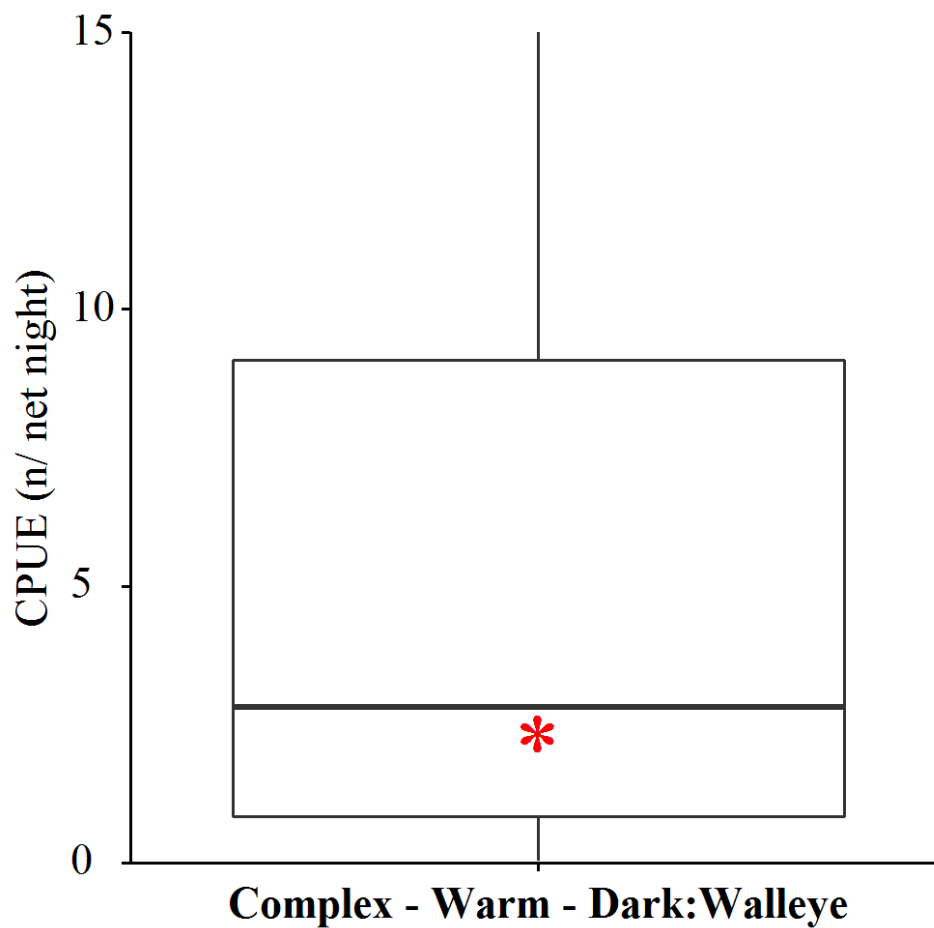


Figure 8. 2016 Lake Kegonsa walleye catch rate (red asterisk) compared to catch rates of fifty-four lakes similar to Lake Kegonsa (boxplot, lower line of box indicates 25th percentile, middle line of box indicates 50th percentile/ median, upper line of box indicates 75th percentile, dot represents statistical outlier, upper and lower whiskers represent data outside the upper and lower quartiles).

Lake Kegonsa Walleye Age Estimates 2016

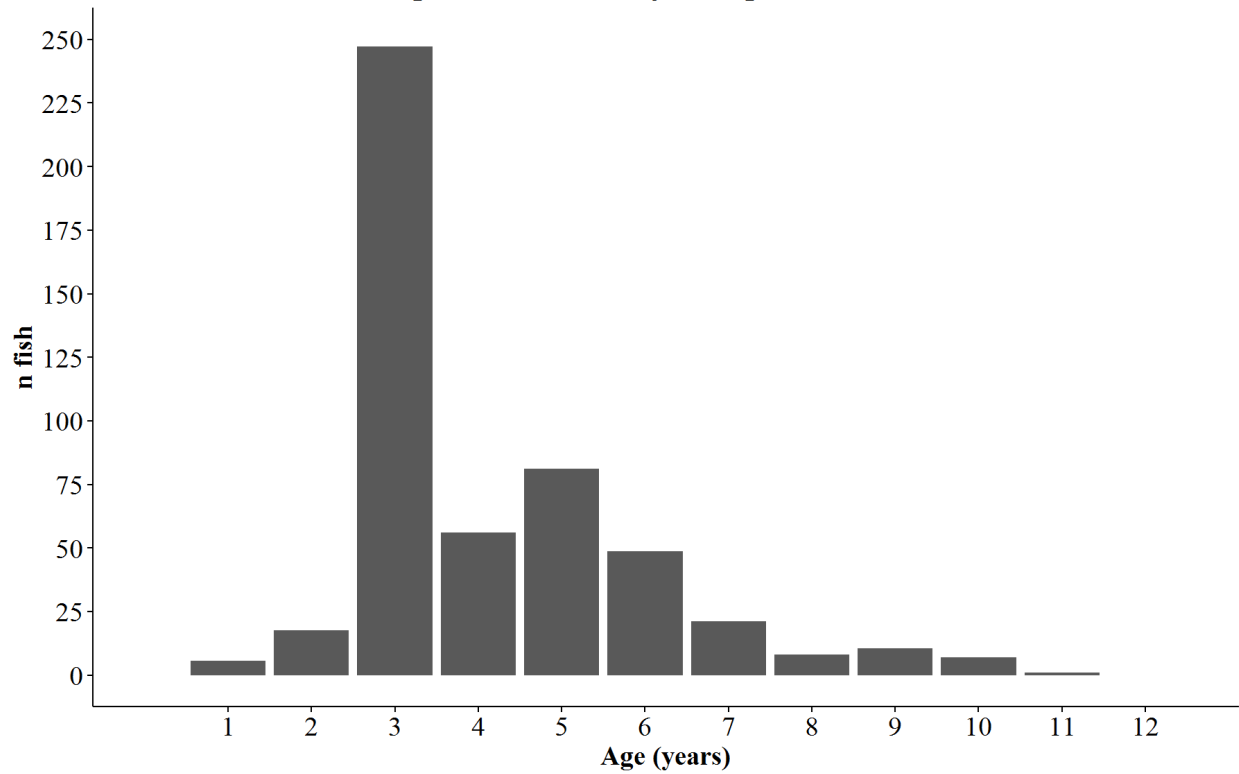


Figure 9. Lake Kegonsa Walleye age demographics. Data derived from 157 subsampled walleye using dorsal spine samples to develop a length-at-age key, then applied to larger sample of 504 fish.

Lake Kegonsa Walleye Total Instantaneous Mortality 2016

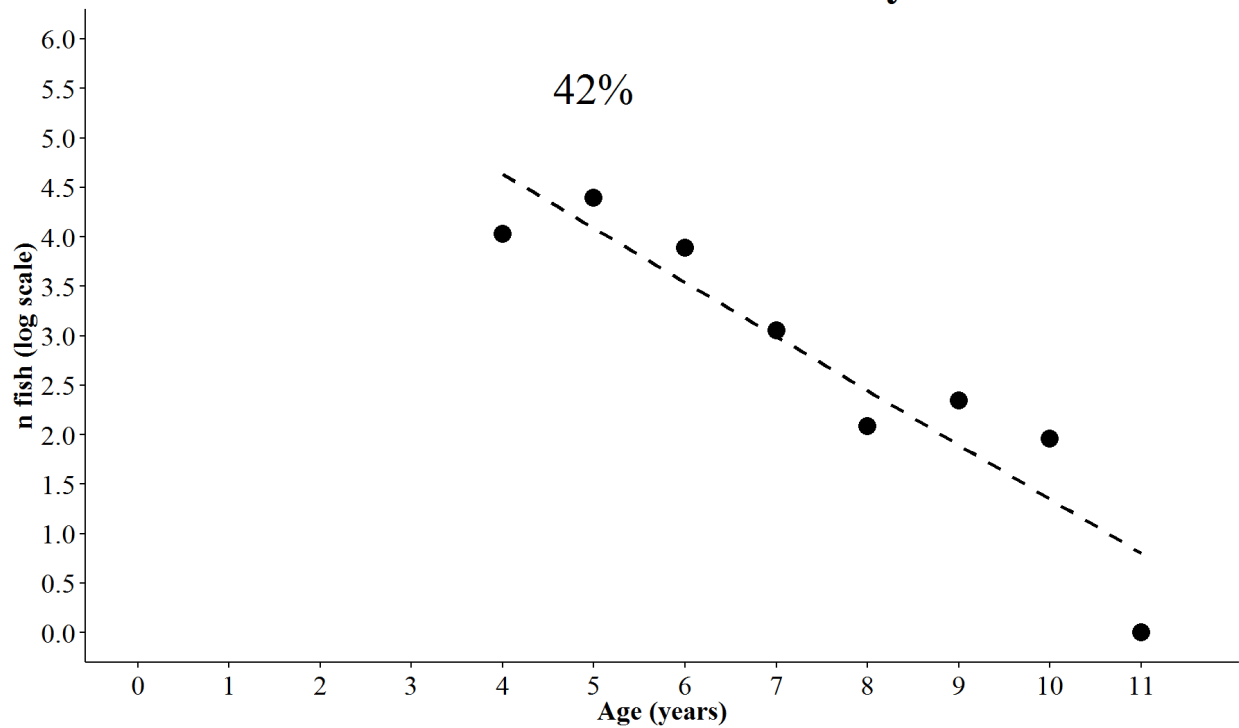


Figure 10. Lake Kegonsa Walleye mortality estimate. The slope of the age-4 to the age-11 fish is the total instantaneous mortality rate (43%). Each year approximately 43% of the total walleye population is lost to some combination of natural mortality, angler harvest, hooking mortality, predation or other causes.

Lake Kegonsa Walleye Relative Weight 2016

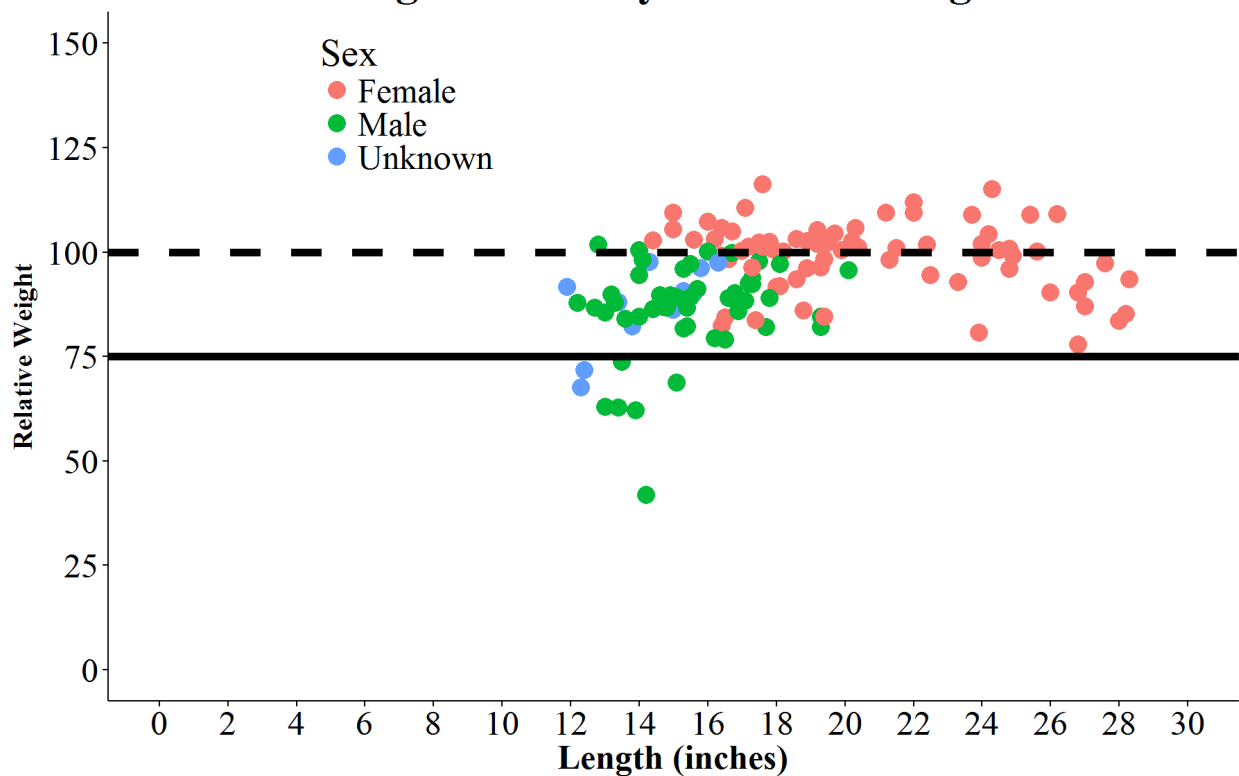


Figure 11. Relative weights of walleye collected during the 2016 Lake Kegonsa comprehensive survey. A relative weight value greater than 100 indicates that a fish is in excellent condition while a relative weight value less than 75 indicates that a fish is in poor condition.

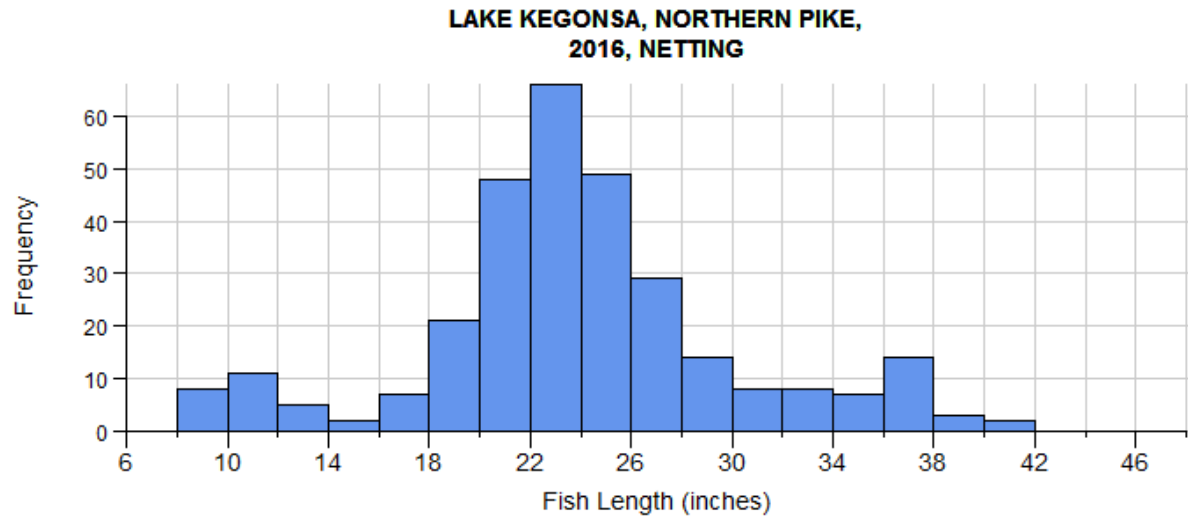


Figure 12. Lake Kegonsa Northern Pike length-frequency histogram from netting survey conducted on March 13 through April 14, 2016. Note the generally normal distribution of the sample with a sharp decline in fish over the legal 26" limit, with some fish surviving to achieve larger size classes, up to 41".

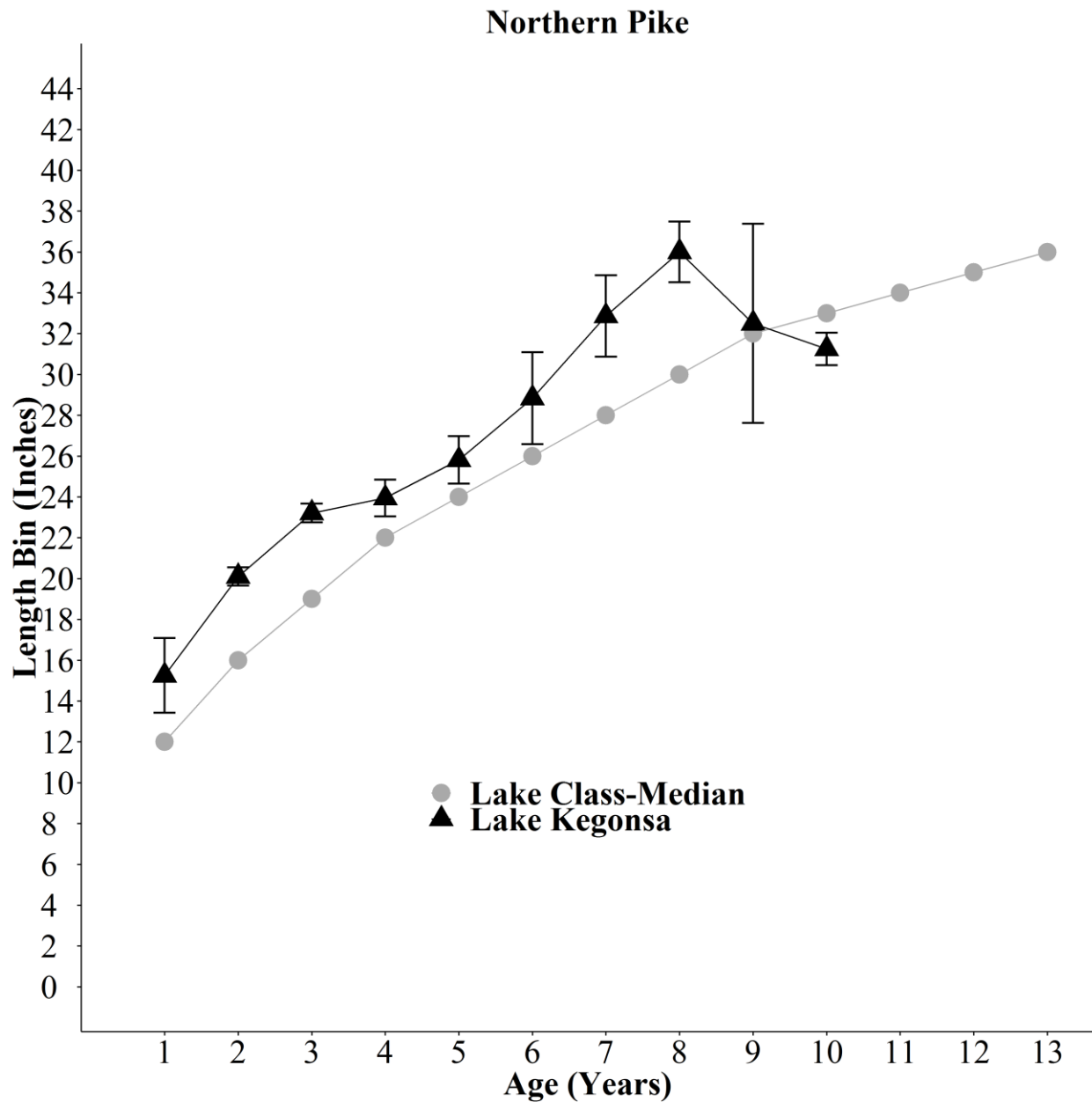


Figure 13. Length-at-age demographics for Northern Pike collected from spring survey conducted on March 13 through April 14, 2016. Lake Kegonsa northern pike ages were estimated using sectioned and polished anal fin rays (dark triangles) and compared to 199 other lakes similar to Lake Kegonsa (light circles). Northern Pike in Lake Kegonsa grow faster and reach longer sizes than their cohorts from similar lakes. Error bars represent 95% confidence intervals around the mean length for given age.

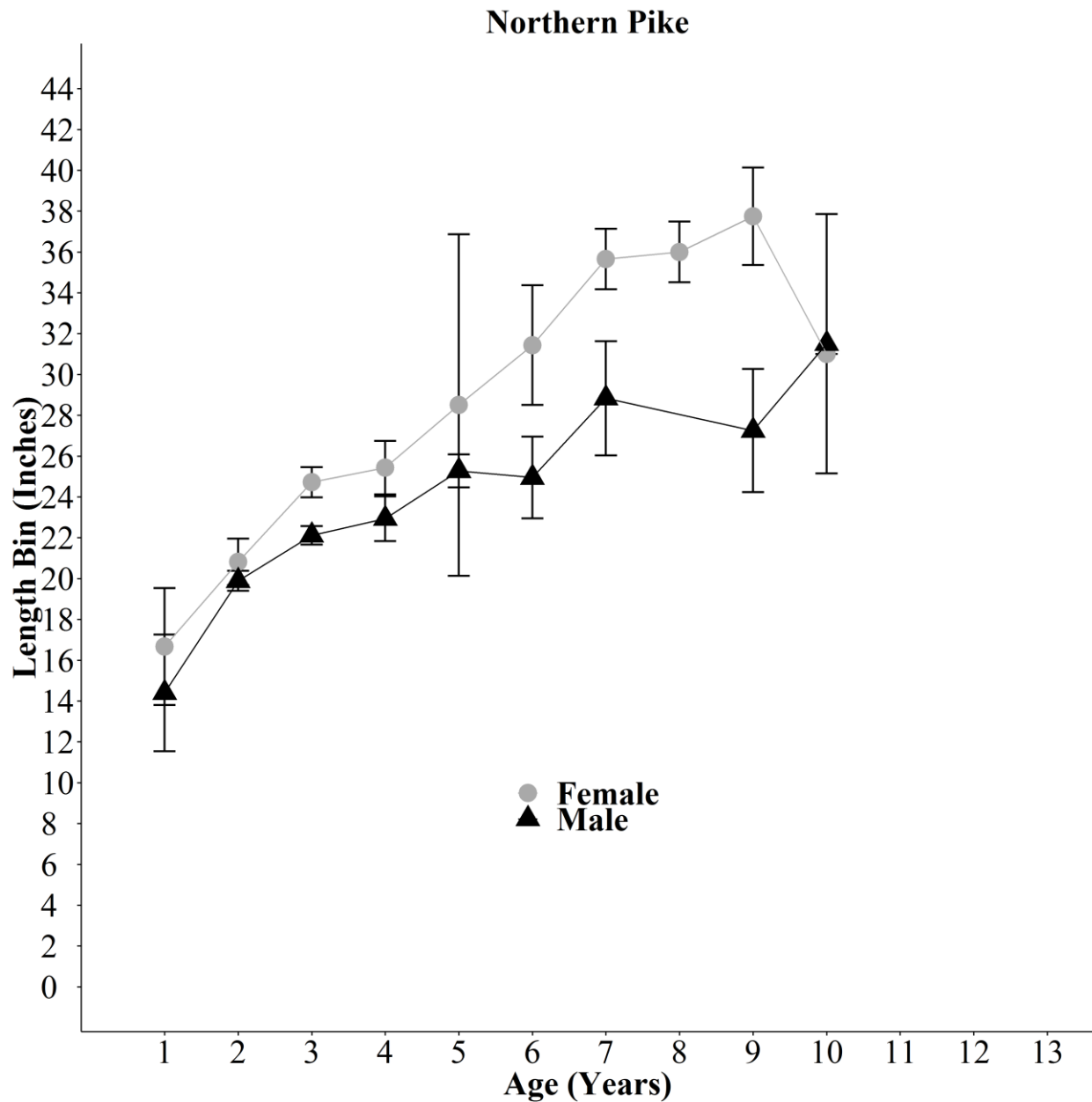


Figure 14. Lake Kegonsa sex-specific length-at-age demographics for Northern Pike males (dark triangles) and females (light circles). Females grow faster, reach longer sizes than males, typical of most Northern Pike populations. Error bars represent 95% confidence intervals around the mean length for given age.

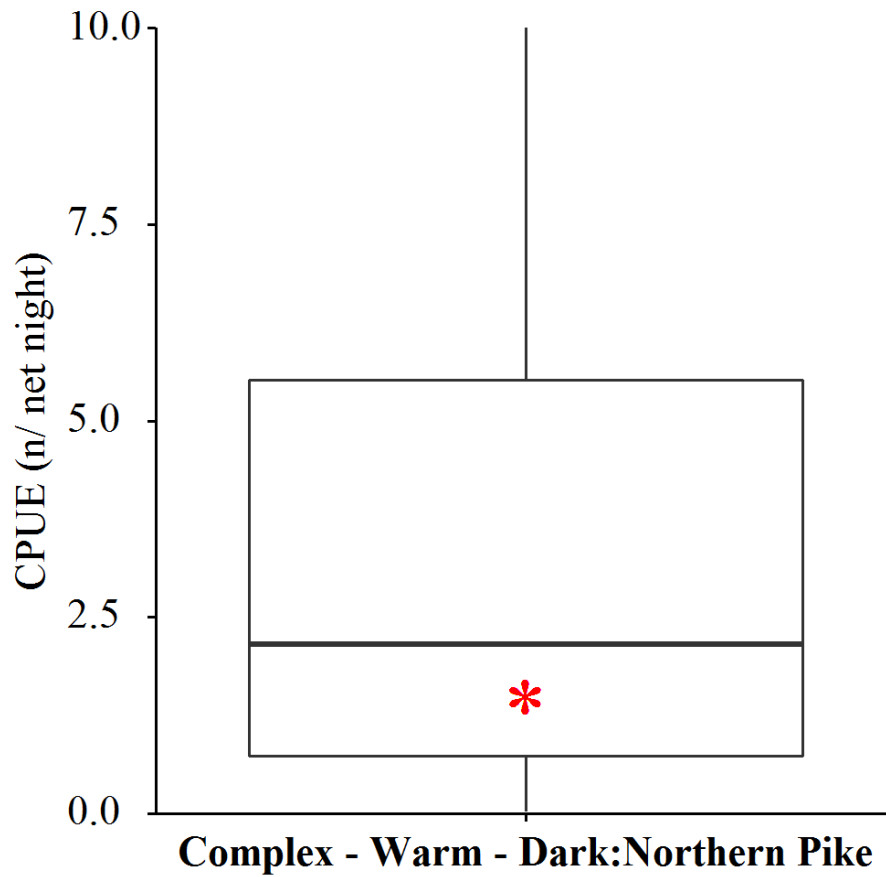


Figure 15. 2016 Lake Kegonsa northern pike catch rate (red asterisk) compared to catch rates of forty-seven lakes similar to Lake Kegonsa (boxplot, lower line of box indicates 25th percentile, middle line of box indicates 50th percentile/ median, upper line of box indicates 75th percentile, upper and lower whiskers represent data outside the upper and lower quartiles).

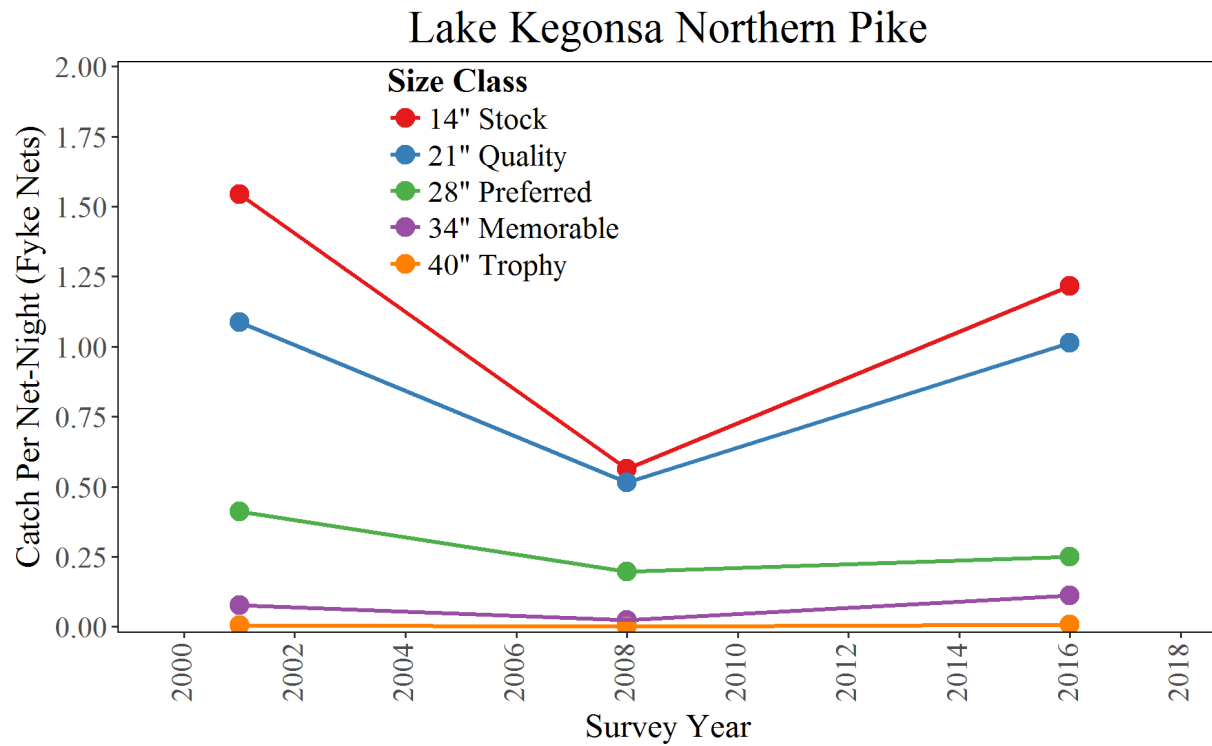


Figure 16. Size-specific catch rates for Lake Kegonsa Northern Pike from years 2001, 2008, and 2016 indicating a relatively stable population across all size-classes.

Lake Kegonsa Northern Pike Age Estimates 2016

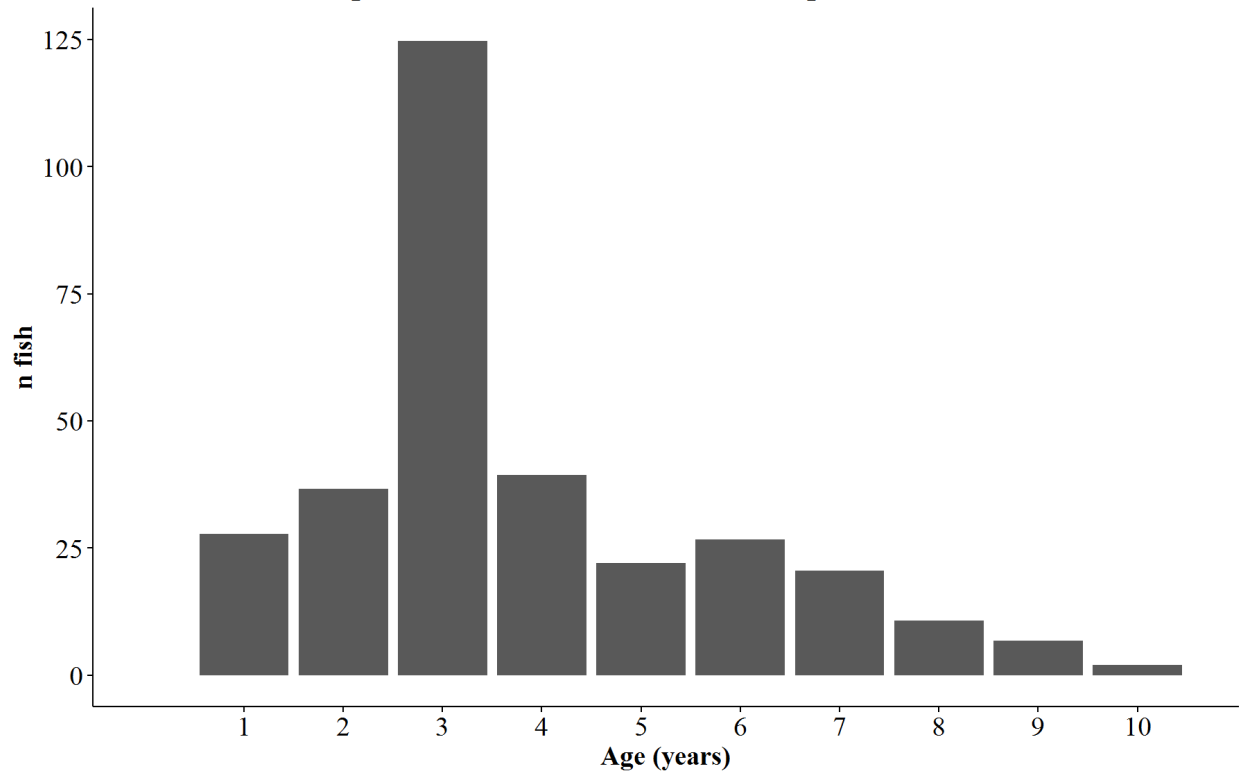


Figure 17. Lake Kegonsa Northern Pike age demographics. Data derived from 164 subsampled northern pike using anal fin ray samples to develop a length-at-age key, then applied to larger sample of 317 fish.

Lake Kegonsa Northern Pike Total Instantaneous Mortality 2016

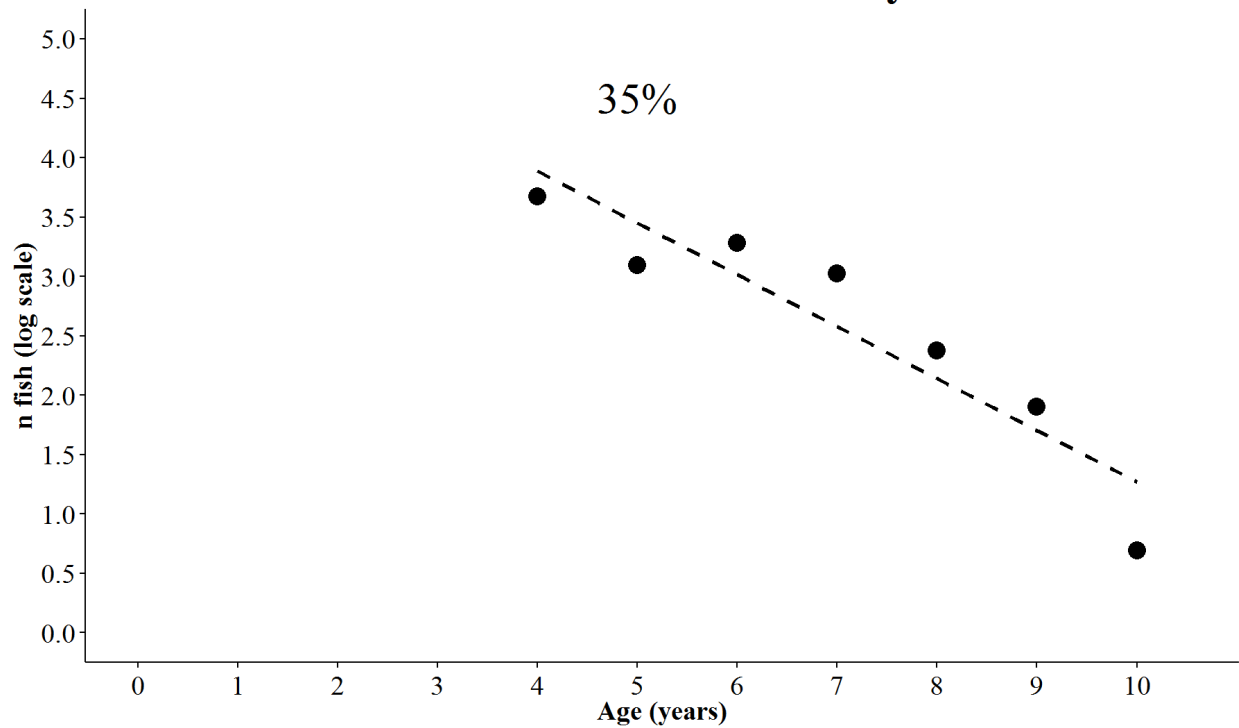


Figure 18. Lake Kegonsa Northern Pike mortality estimate. The slope of the age-4 to the age-10 fish is the total instantaneous mortality rate (38%). Each year approximately 38% of the total northern pike population is lost to some combination of natural mortality, angler harvest, hooking mortality, predation or other causes

Lake Kegonsa Northern Pike Relative Weight 2016

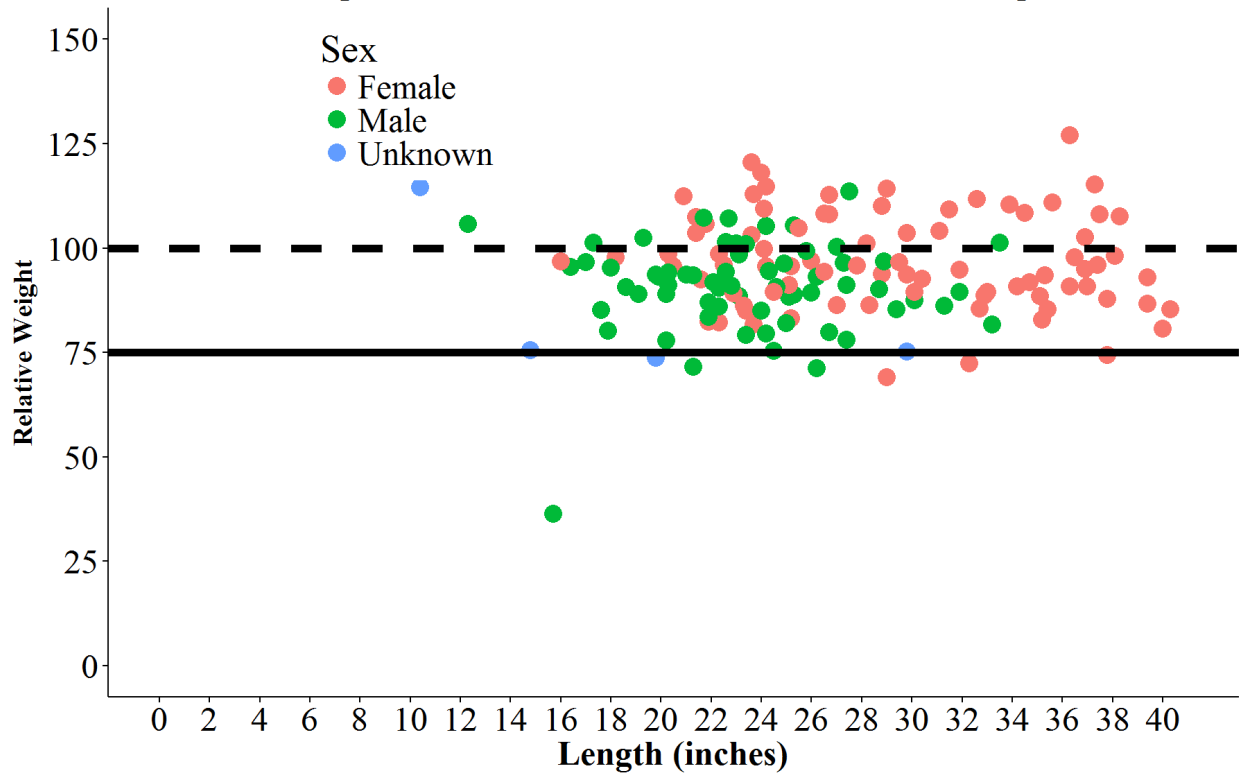


Figure 19. Relative weights of northern pike collected during the 2016 Lake Kegonsa comprehensive survey. A relative weight value greater than 100 indicates that a fish is in excellent condition while a relative weight value less than 75 indicates that a fish is in poor condition.

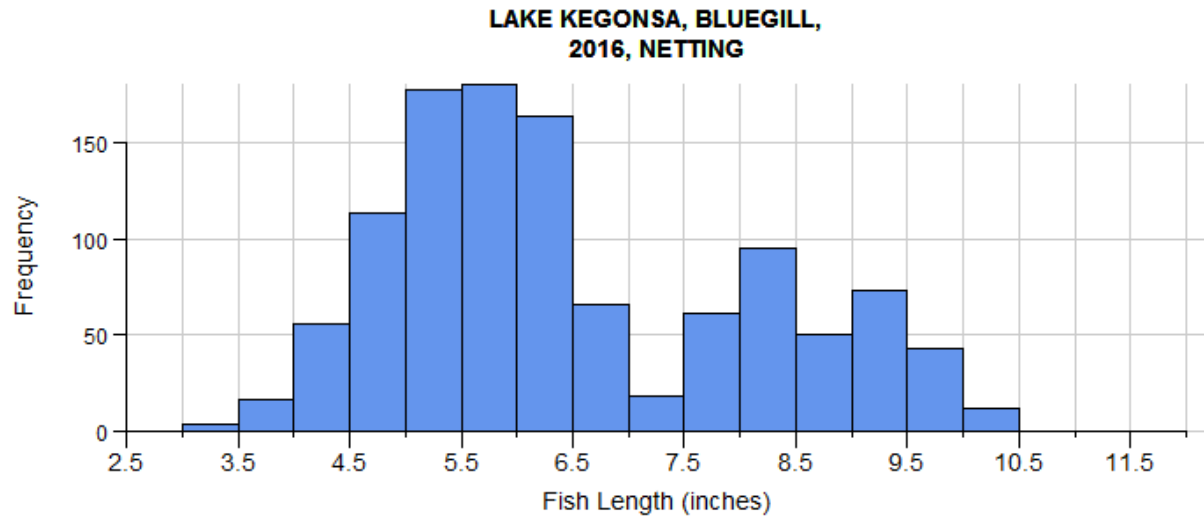


Figure 20. Lake Kegonsa Bluegill length-frequency histogram from netting survey conducted on March 13 through April 14, 2016. Bluegills from multiple year classes is indicative of reproductive success. Note the decline in the number of 6.5" and greater sizes, likely due to heavy angler preference for larger fish.

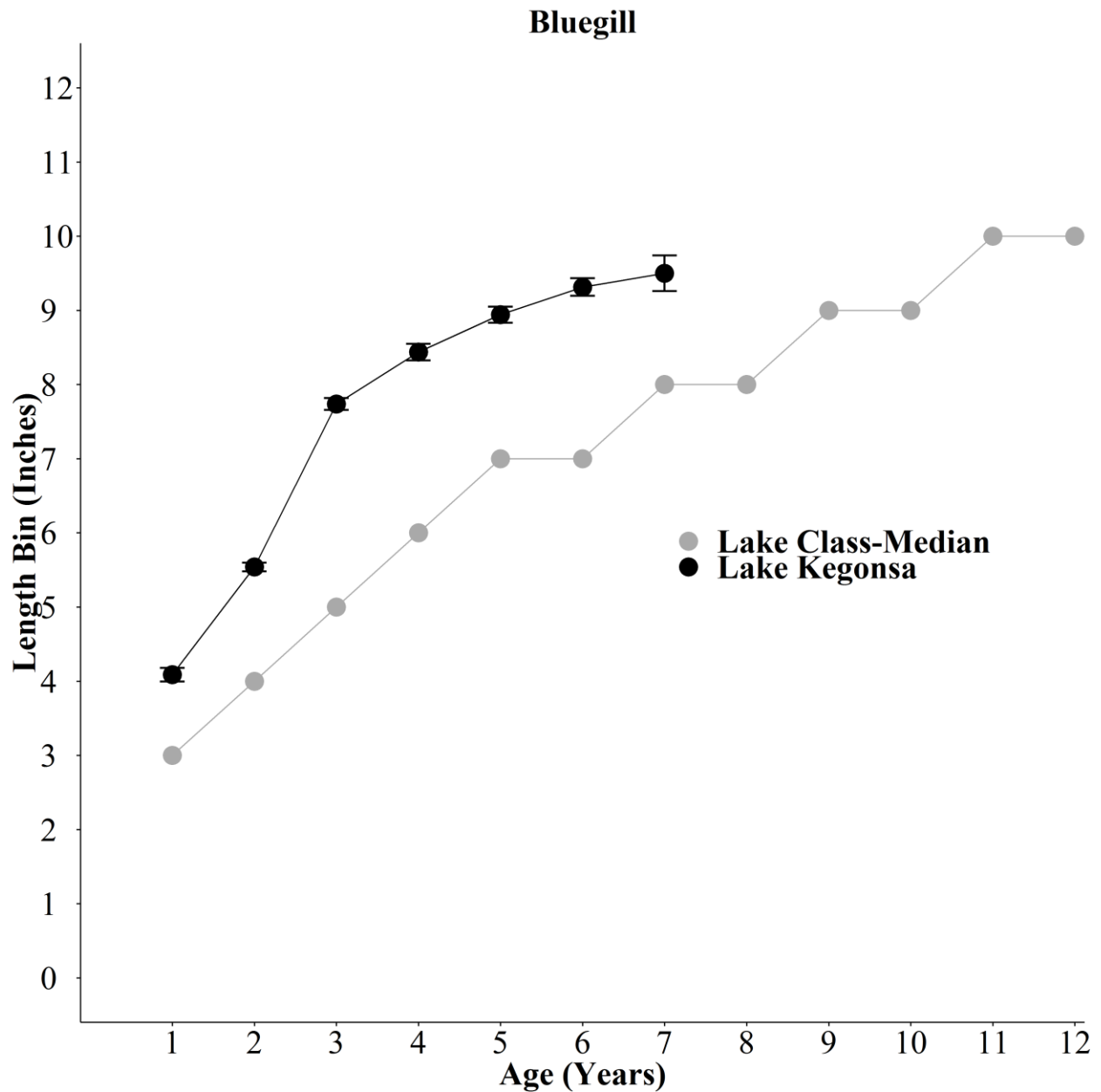


Figure 21. Length-at-age demographics for bluegill collected from spring survey conducted on March 13 through April 14, 2016. Lake Kegonsa bluegill ages were estimated using sectioned and polished dorsal spines (dark circles) and compared to 199 other lakes similar to Lake Kegonsa (light circles). Bluegills in Lake Kegonsa grow faster and reach longer sizes than their cohorts from similar lakes. Error bars represent 95% confidence intervals around the mean length for given age.

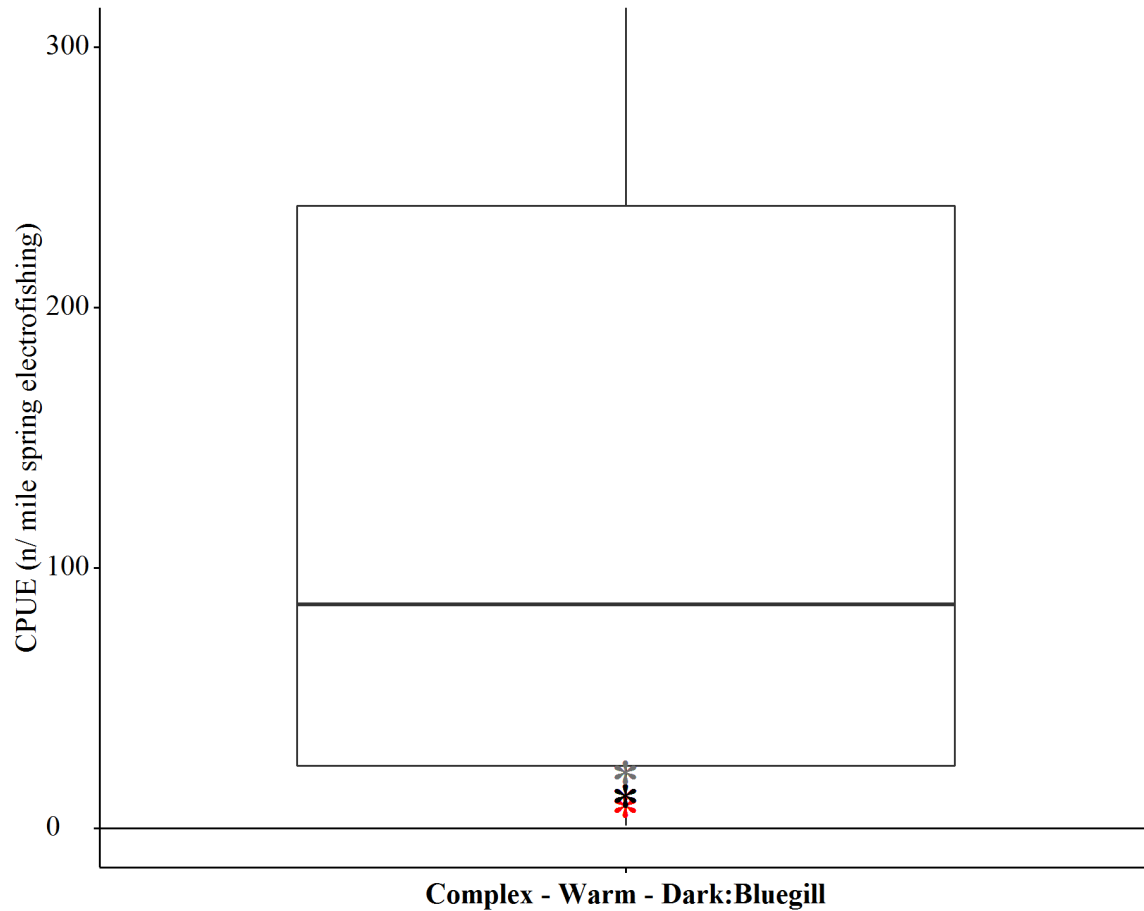


Figure 22. 2016 Lake Kegonsa bluegill catch rates for 2016 (red asterisk), 2017 (black asterisk), and 2018 (gray asterisk) compared to catch rates of fifty-one lakes similar to Lake Kegonsa (boxplot, lower line of box indicates 25th percentile, middle line of box indicates 50th percentile/ median, upper line of box indicates 75th percentile, upper and lower whiskers represent data outside the upper and lower quartiles).

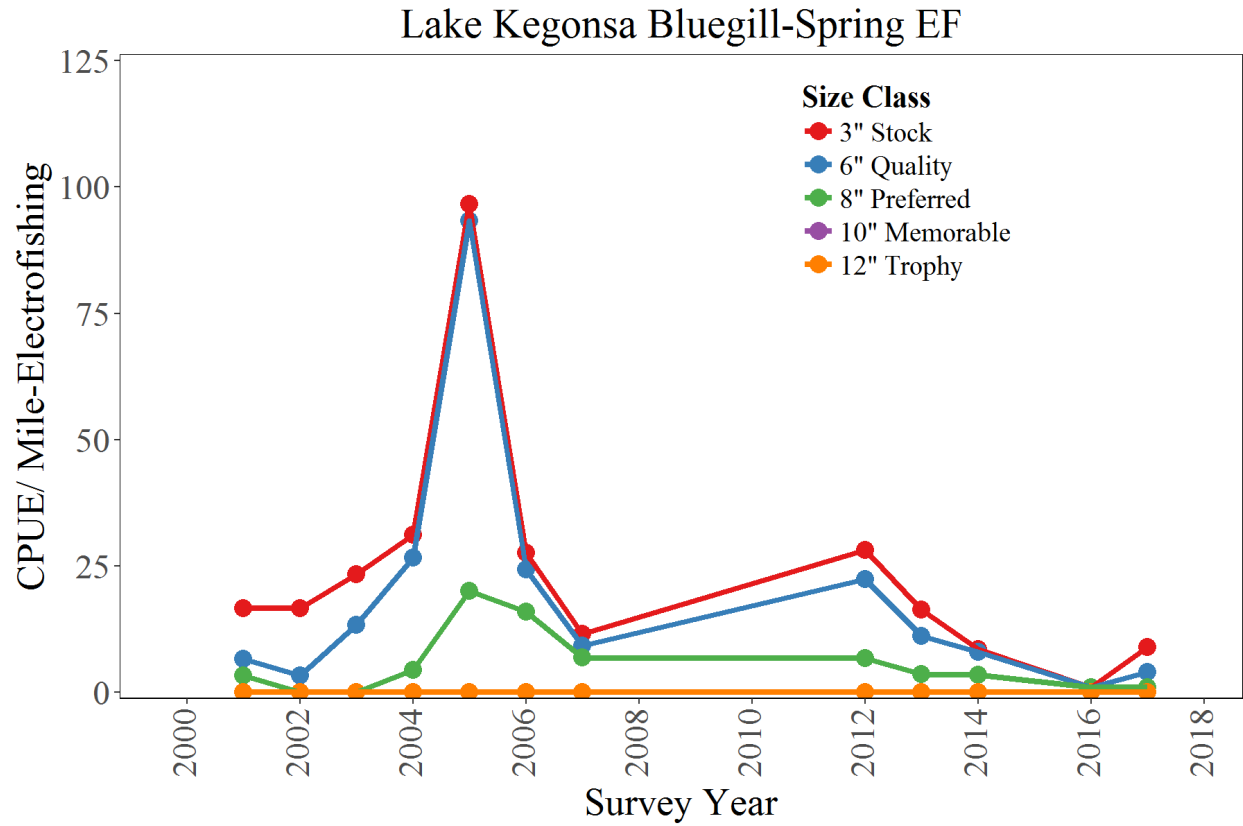


Figure 23. Size-specific catch rates for Lake Kegonsa Bluegills from years 2001-2007, 2012 through 2017 showing a marked decline across all sizes since 2005.

Lake Kegonsa Bluegill Age Estimates 2016

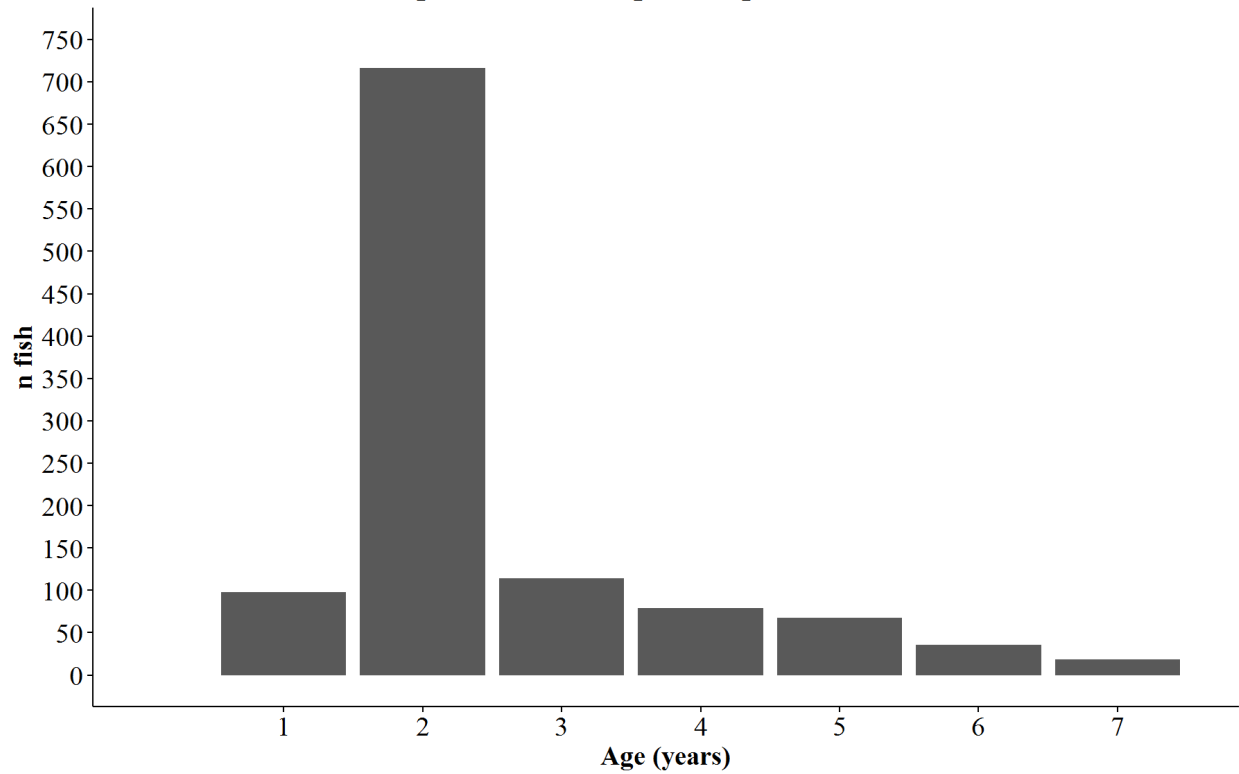


Figure 24. Lake Kegonsa Bluegill age demographics. Data derived from 72 subsampled fish using dorsal spine samples to develop a length-at-age key, then applied to larger sample of 1129 fish.

Lake Kegonsa Bluegill Total Instantaneous Mortality 2016

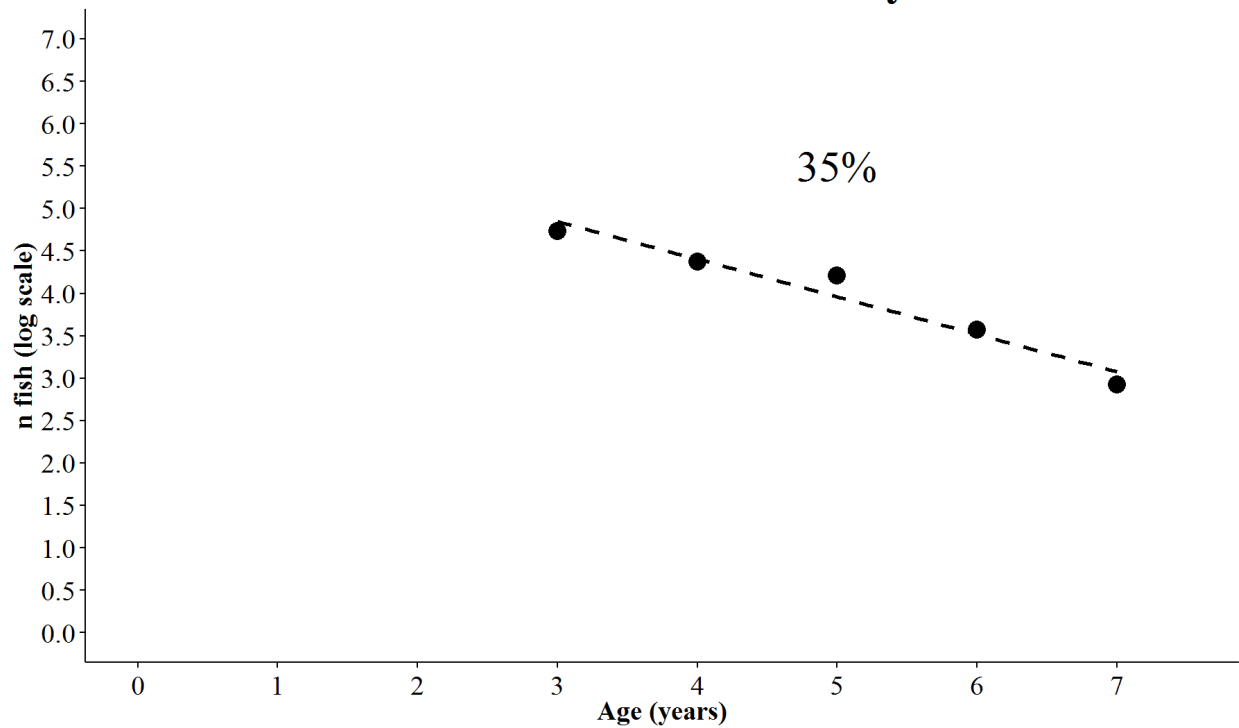


Figure 25. Lake Kegonsa Bluegill mortality estimate. The slope of the age-3 to the age-7 fish is the total instantaneous mortality rate (46%). Each year approximately 46% of the total bluegill population is lost to some combination of natural mortality, angler harvest, hooking mortality, predation or other causes

Lake Kegonsa Bluegill Relative Weight 2016

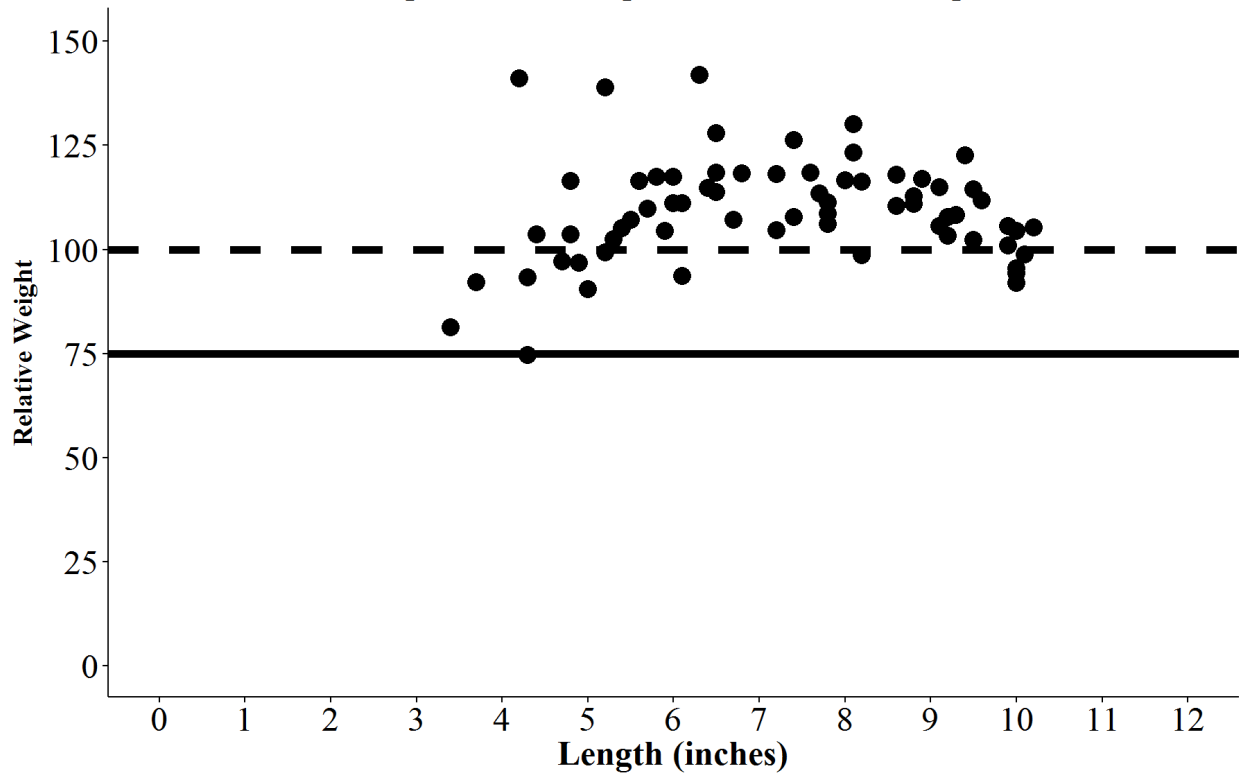


Figure 26. Relative weights of bluegills collected during the 2016 Lake Kegonsa comprehensive survey. A relative weight value greater than 100 indicates that a fish is in excellent condition while a relative weight value less than 75 indicates that a fish is in poor condition.

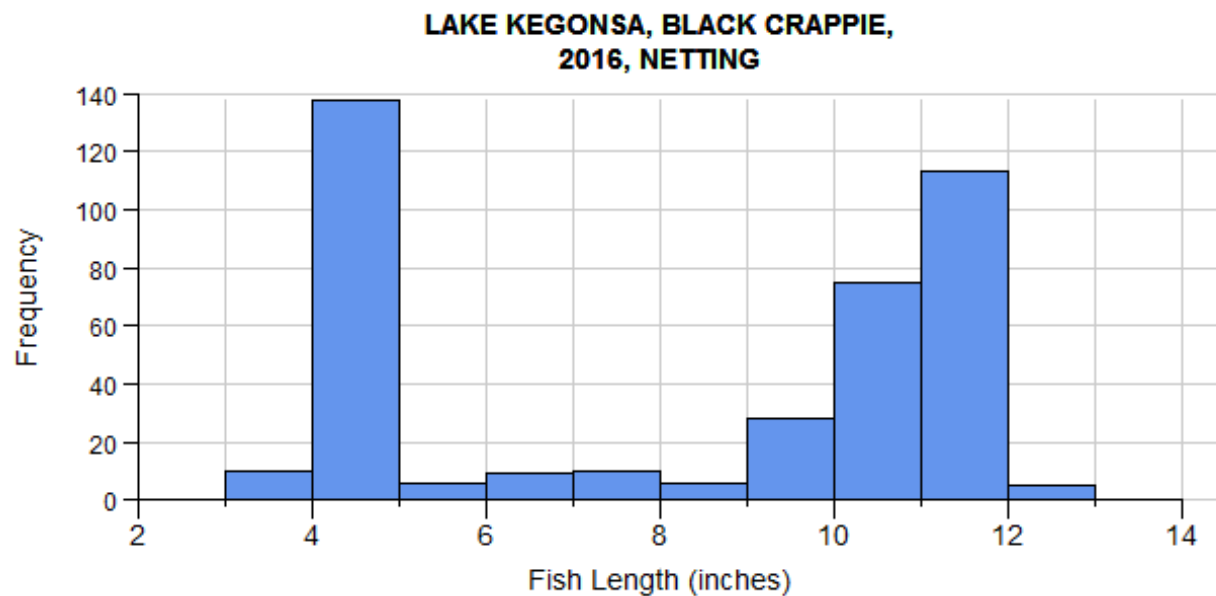


Figure 27. Lake Kegonsa Black Crappie length-frequency histogram from netting survey conducted on March 13 through April 14, 2016. A strong year-class of juvenile fish is growing and entering the fishery within the 4-5" range and large adults persist in the population despite angling pressure in the 10-12" range.

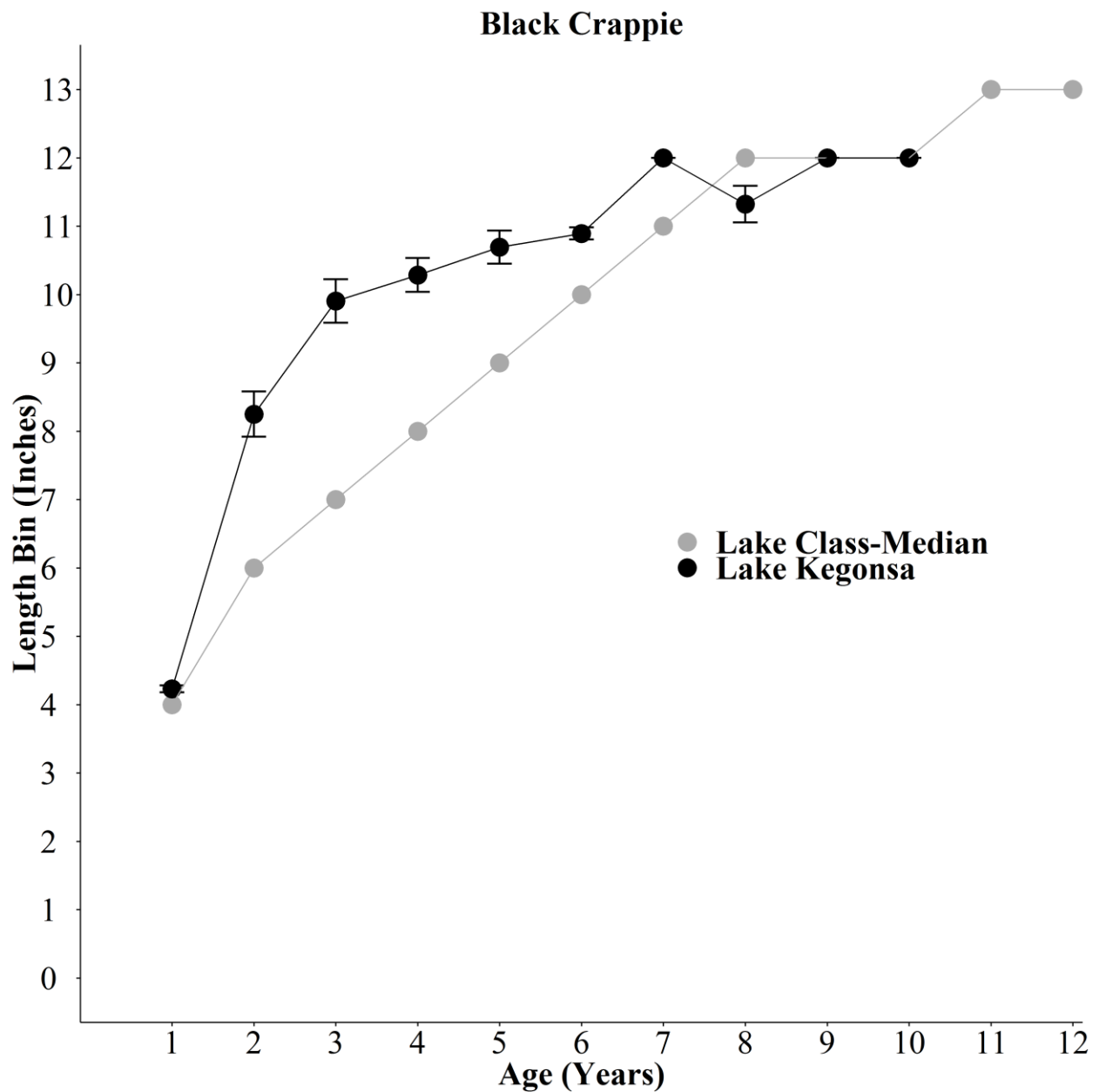


Figure 28. Length-at-age demographics for Black Crappie collected from spring survey conducted on March 13 through April 14, 2016. Lake Kegonsa Black Crappie ages were estimated using sectioned and polished dorsal spines (dark circles) and compared to 199 other lakes (light circles) similar to Lake Kegonsa. Black Crappie in Lake Kegonsa grow faster and reach longer sizes than their cohorts from other lakes. Error bars represent 95% confidence intervals around the mean length for given age.

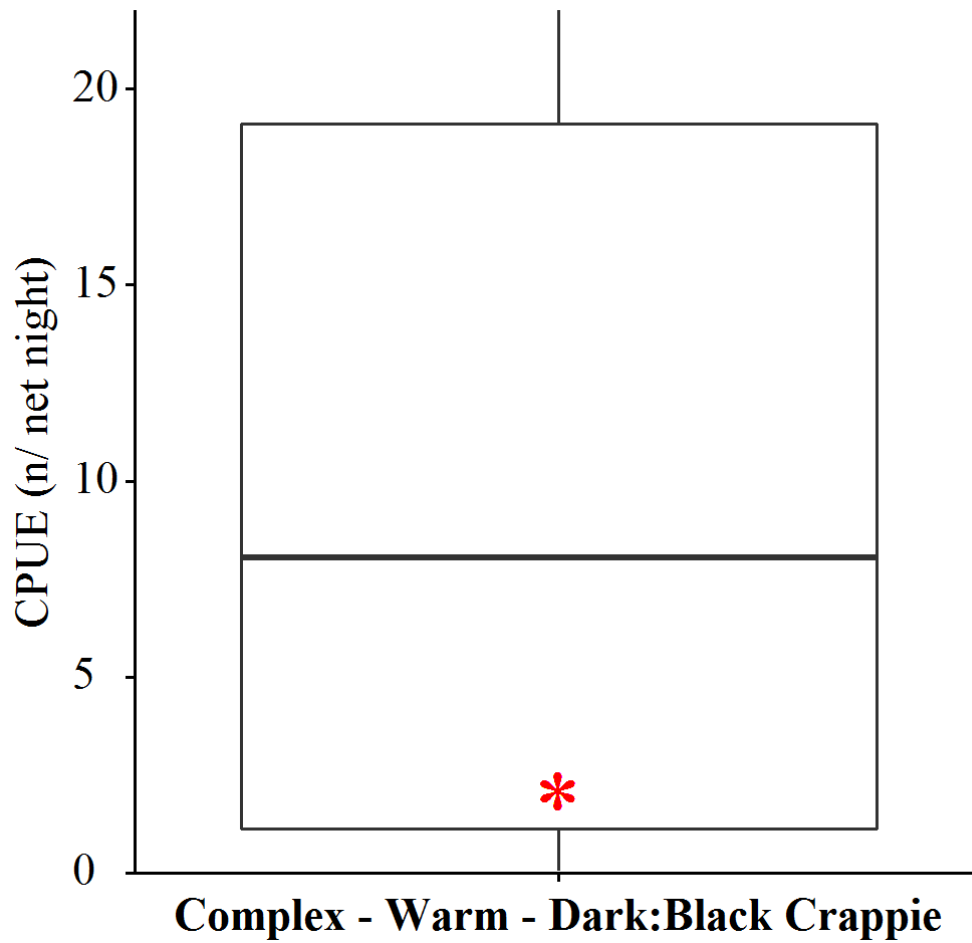


Figure 29. 2016 Lake Kegonsa black crappie catch rate (red asterisk) compared to catch rates of forty lakes similar to Lake Kegonsa (boxplot, lower line of box indicates 25th percentile, middle line of box indicates 50th percentile/ median, upper line of box indicates 75th percentile, upper and lower whiskers represent data outside the upper and lower quartiles).

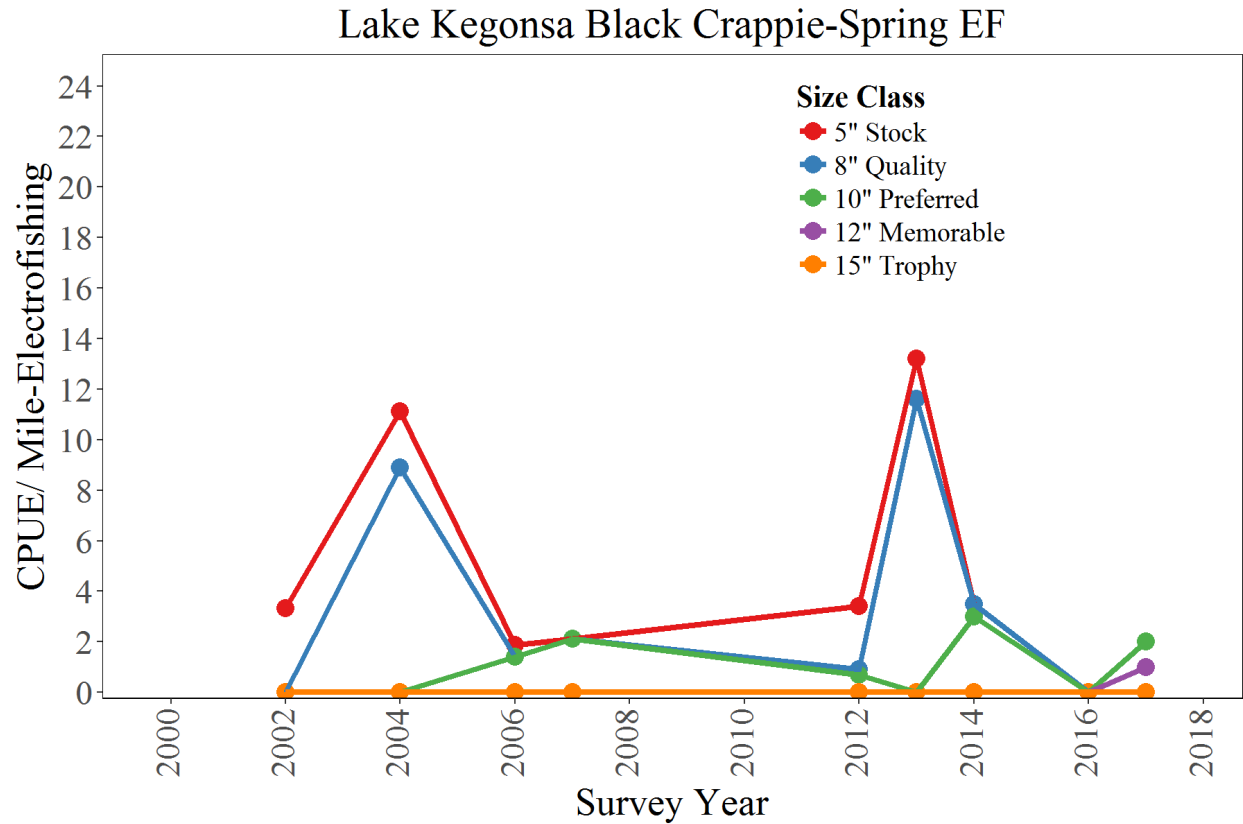


Figure 30. Size-specific catch rates for Lake Kegonsa Black Crappies from years 2002-2007, 2012 through 2017 showing a common theme in crappie populations: boom and bust cycles of successful year classes with low relative abundance years in between.

Lake Kegonsa Black Crappie Age Estimates 2016

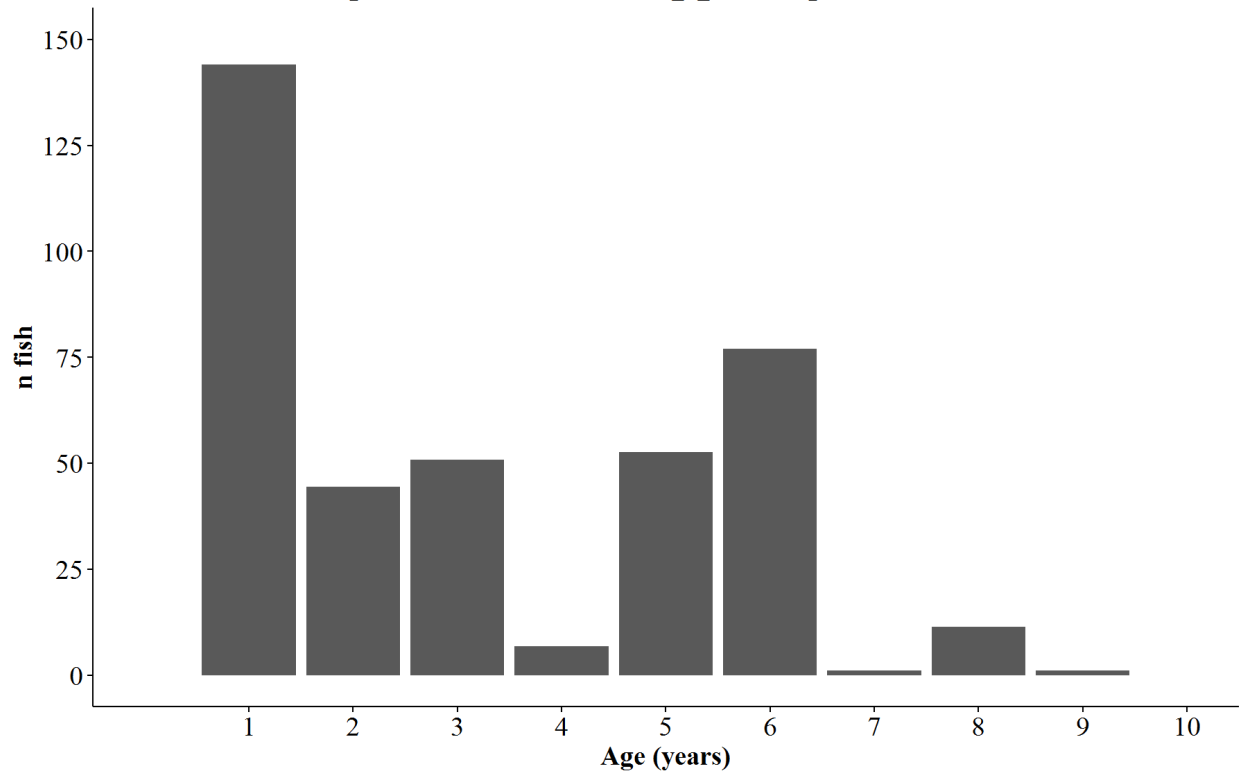


Figure 31. Lake Kegonsa Black Crappie age demographics. Data derived from 69 subsampled fish using dorsal spine samples to develop a length-at-age key, then applied to larger sample of 390 fish.

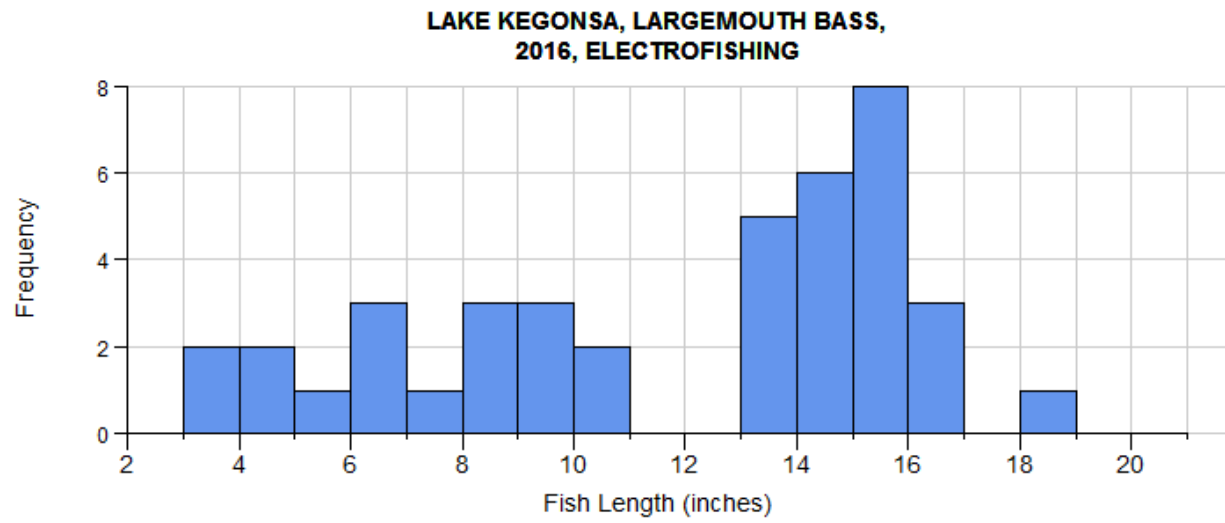


Figure 32. Lake Kegonsa Largemouth Bass length-frequency diagram from electrofishing survey conducted in spring of 2016.

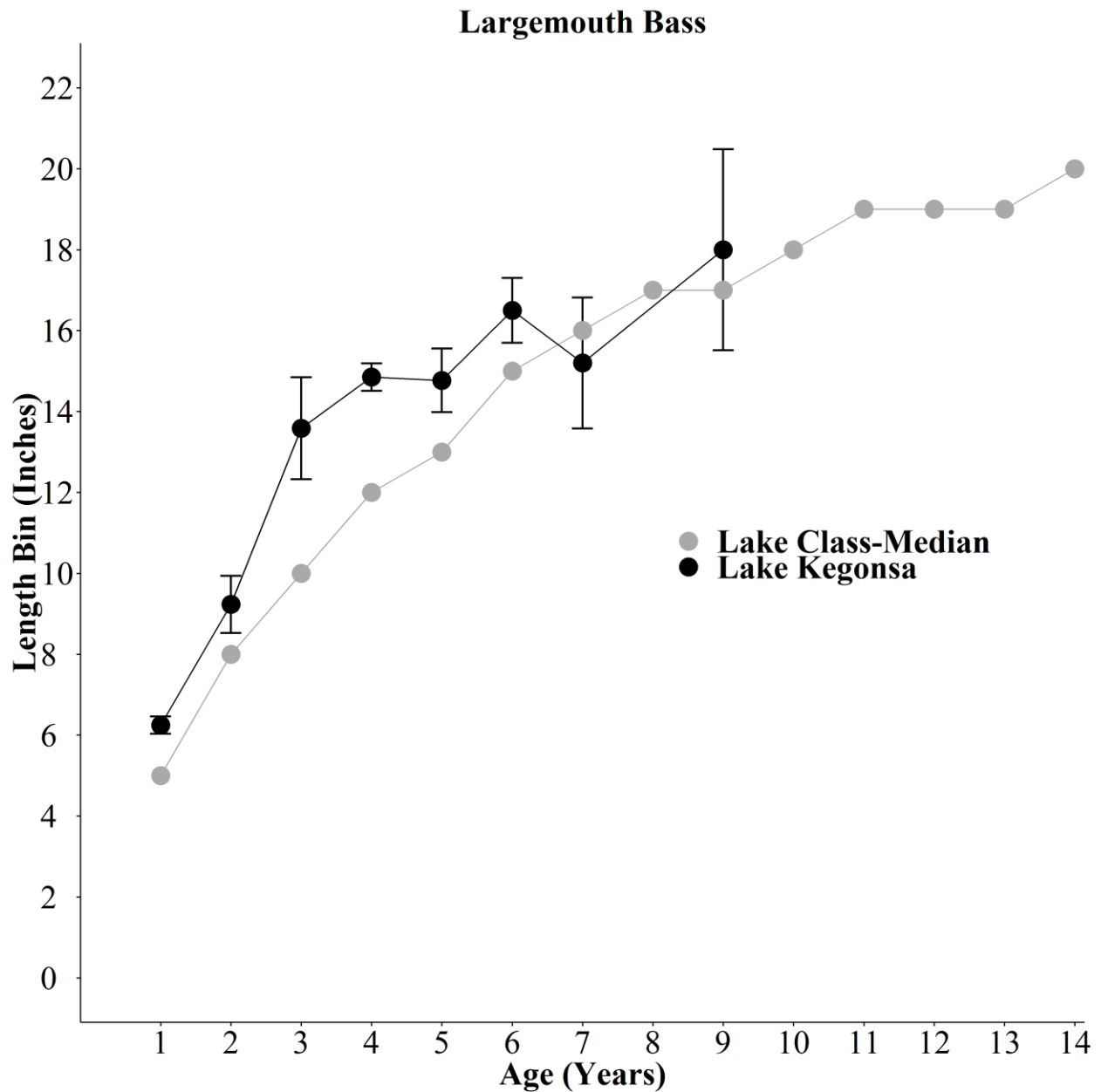


Figure 33. Length-at-age demographics for Largemouth Bass collected from spring survey conducted on March 13 through April 14, 2016. Lake Kegonsa Largemouth Bass ages were estimated using sectioned and polished dorsal spines (dark circles) and compared to 199 other lakes similar to Lake Kegonsa (light circles). Largemouth Bass in Lake Kegonsa typically grow faster and reach longer sizes than their cohorts from other lakes. Error bars represent 95% confidence intervals around the mean length for given age.

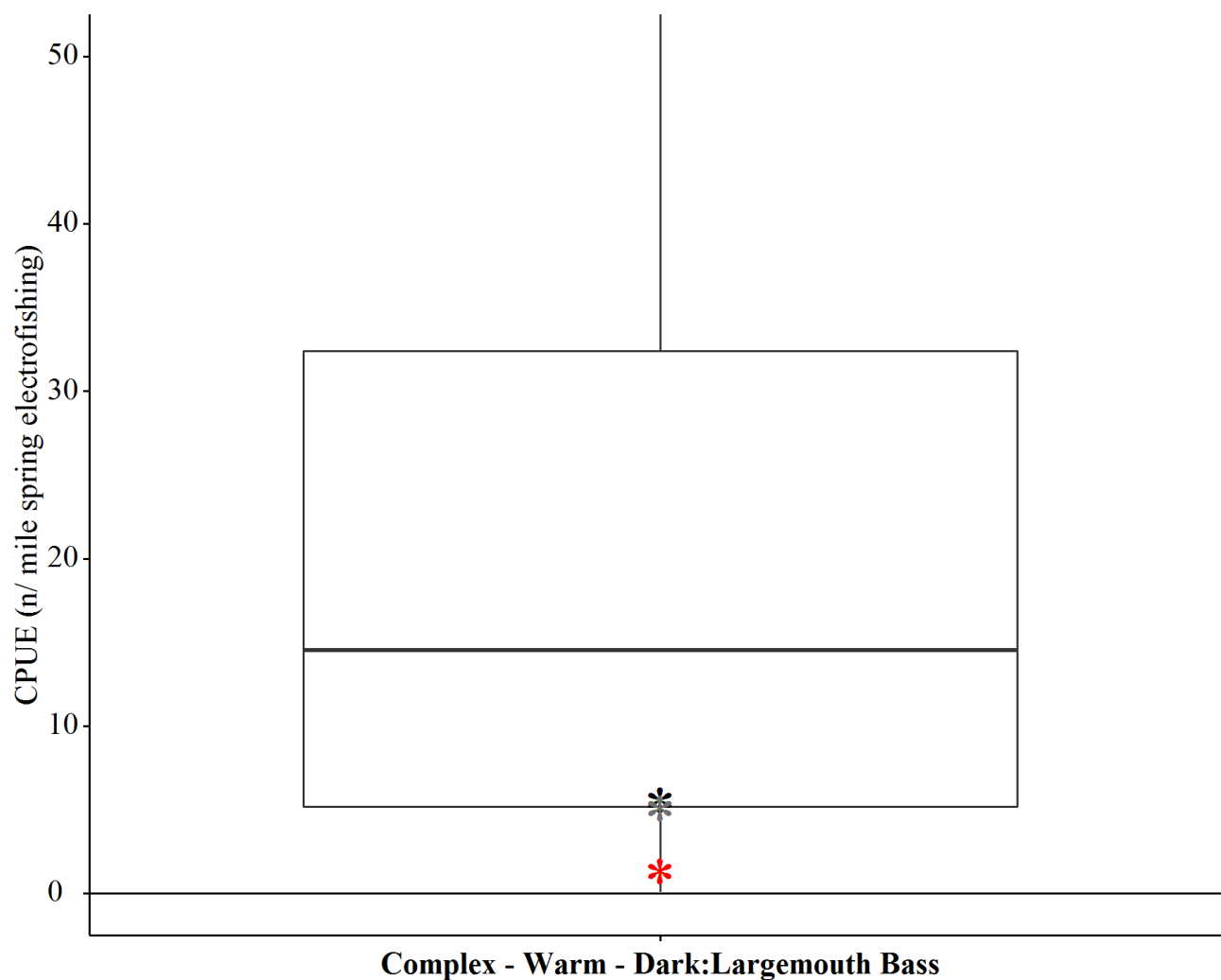


Figure 34. 2016 Lake Kegonsa largemouth bass catch rates for 2016 (red asterisk), 2017 (black asterisk), and 2018 (gray asterisk) compared to catch rates of fifty-seven lakes similar to Lake Kegonsa (boxplot, lower line of box indicates 25th percentile, middle line of box indicates 50th percentile/ median, upper line of box indicates 75th percentile, upper and lower whiskers represent data outside the upper and lower quartiles).

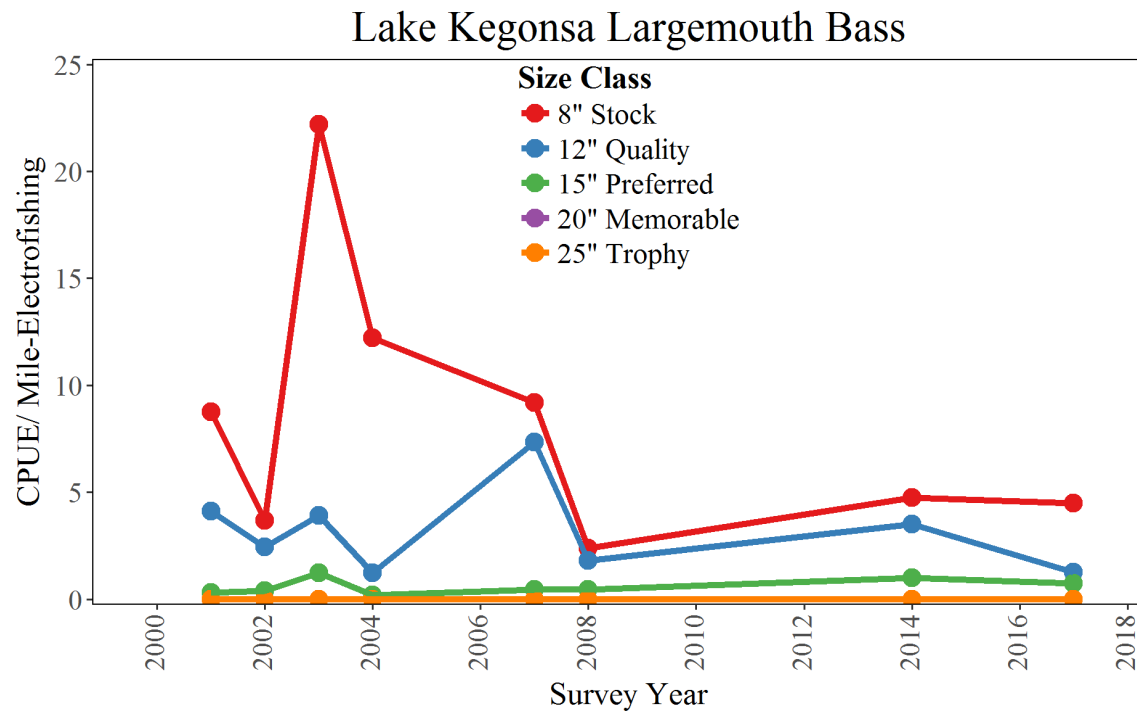


Figure 35. Size-specific catch rates for Lake Kegonsa Largemouth Bass 2001-2016 indicating a modest but stable population across all size-classes since 2008.

Lake Kegonsa Largemouth Bass Age Estimates 2016

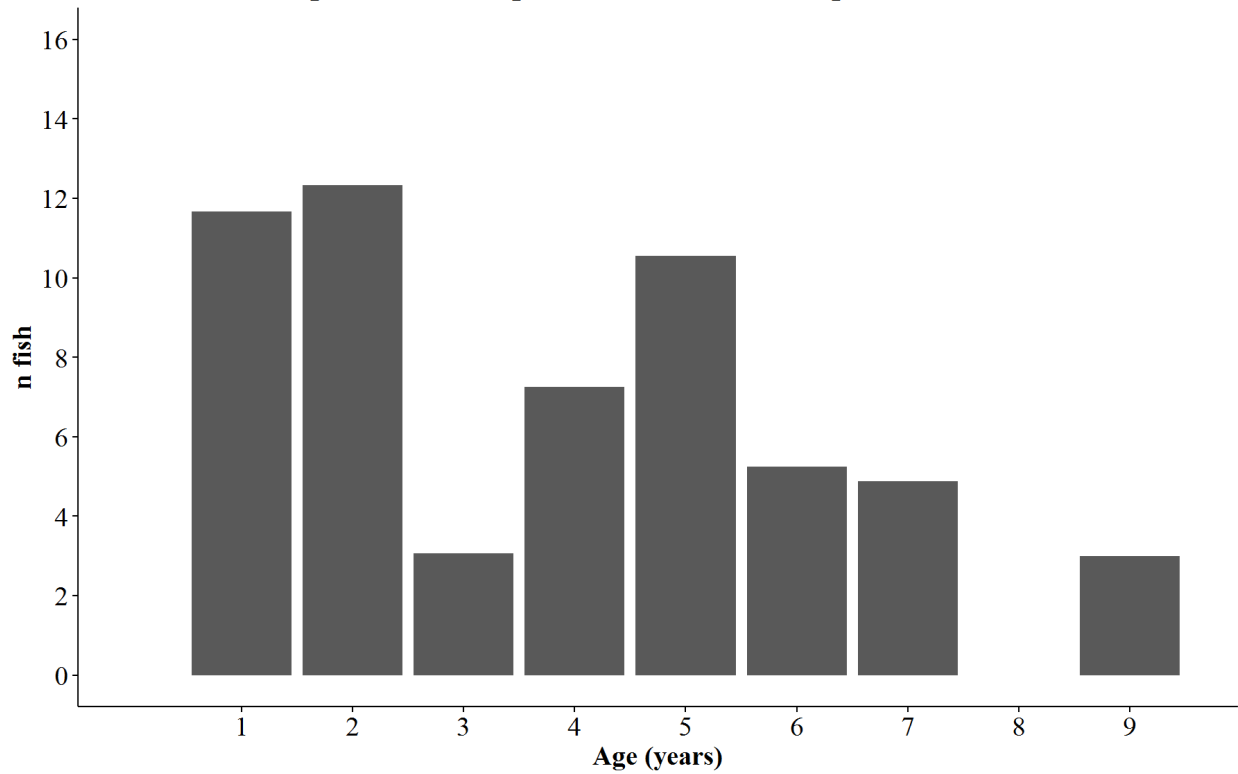


Figure 36- Lake Kegonsa Largemouth Bass age demographics. Data derived from 58 subsampled fish using dorsal spine samples to develop a length-at-age key, then applied to larger sample of 60 fish.

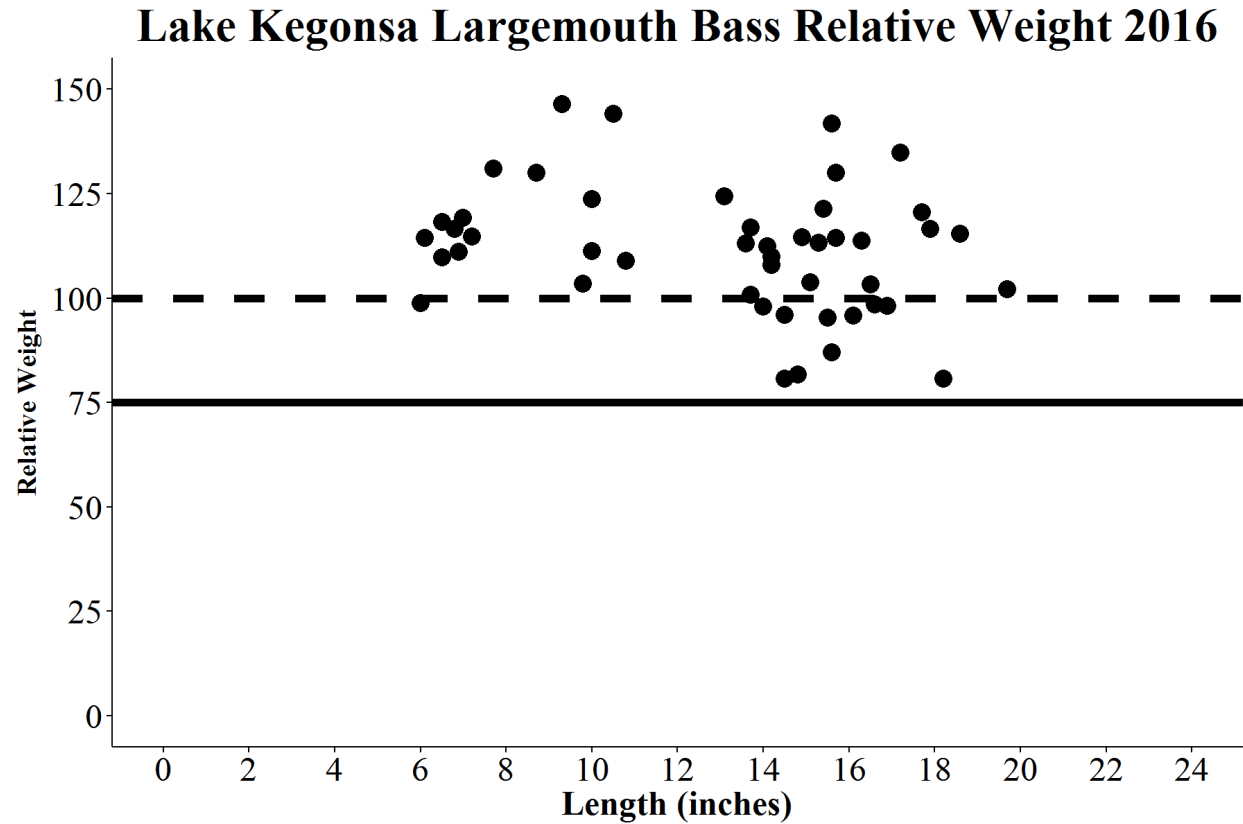


Figure 37. Relative weights of largemouth bass collected during the 2016 Lake Kegonsa comprehensive survey. A relative weight value greater than 100 indicates that a fish is in excellent condition while a relative weight value less than 75 indicates that a fish is in poor condition.

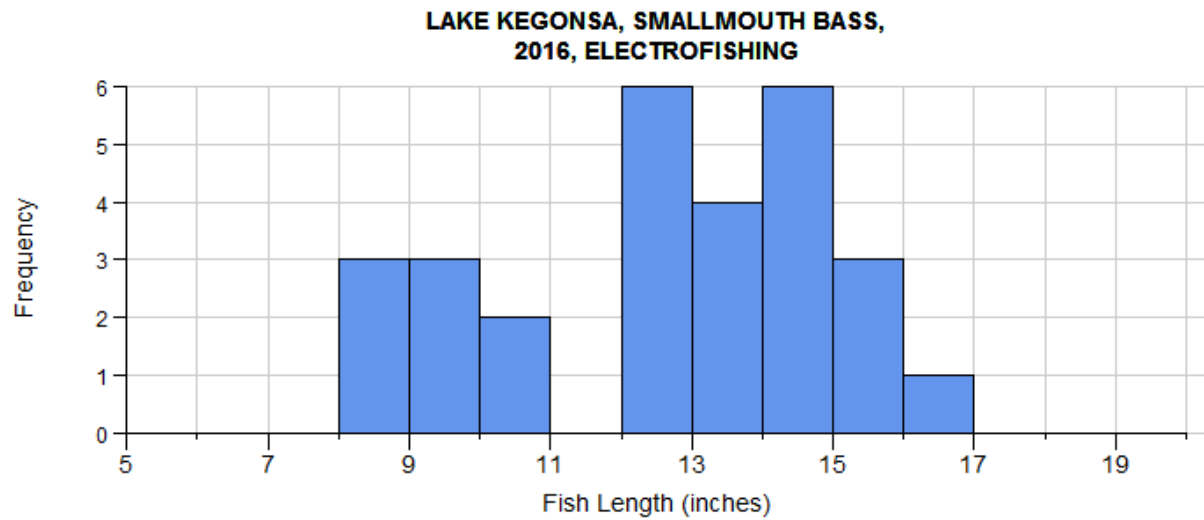


Figure 38. Lake Kegonsa Smallmouth Bass length-frequency histogram from electrofishing survey conducted in spring of 2016. Catches were modest in both netting and electrofishing surveys and both methods yielded similar results in terms of sizes and ages of fish handled. Smallmouth bass ranged from 8" to 17".

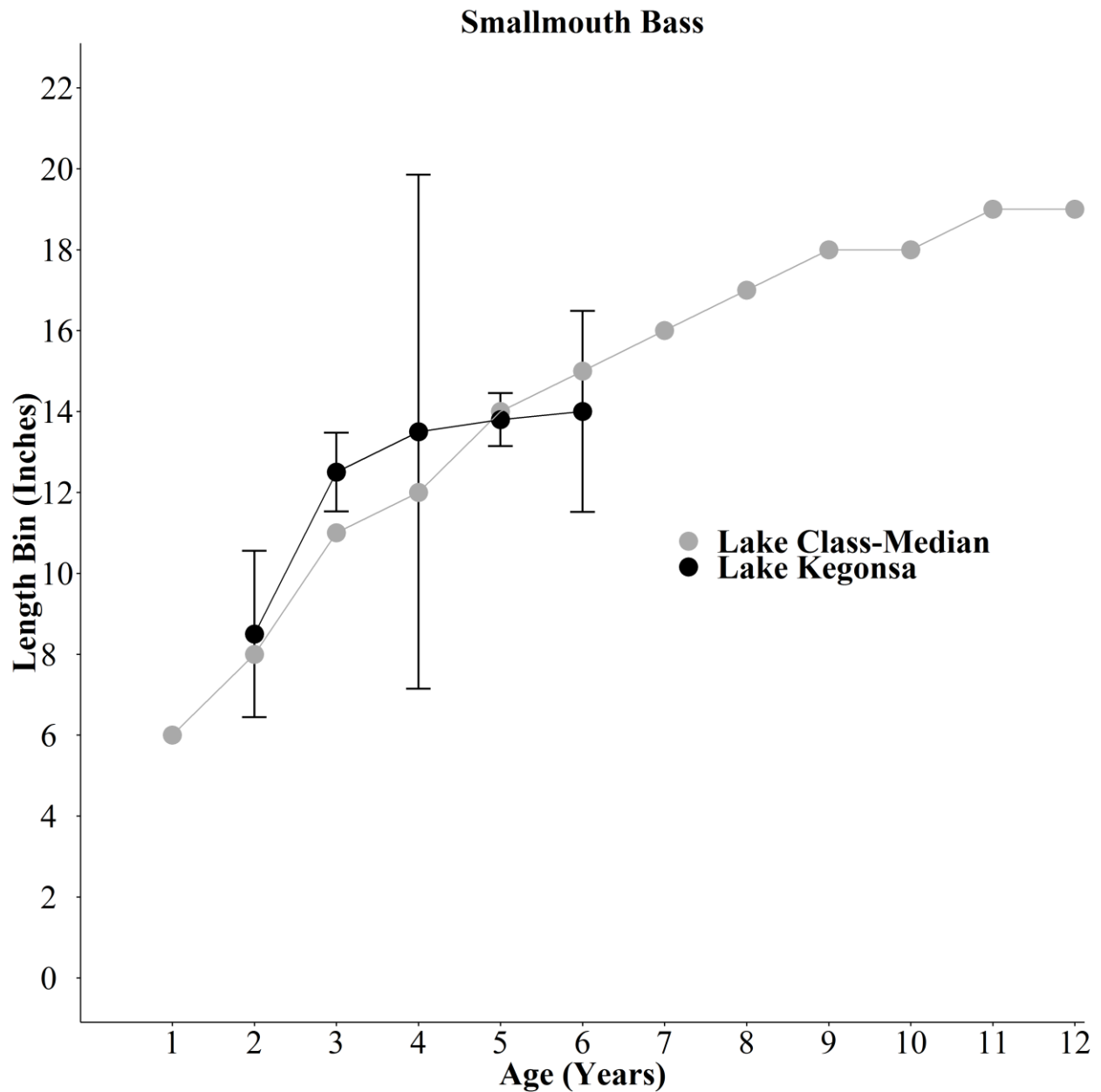


Figure 39. Length-at-age demographics for Smallmouth Bass collected from spring survey conducted on March 13 through April 14, 2016. Lake Kegonsa Smallmouth Bass ages were estimated using sectioned and polished dorsal spines (dark circles) and compared to 199 other lakes similar to Lake Kegonsa (light circles). Error bars represent 95% confidence intervals around the mean length for given age.

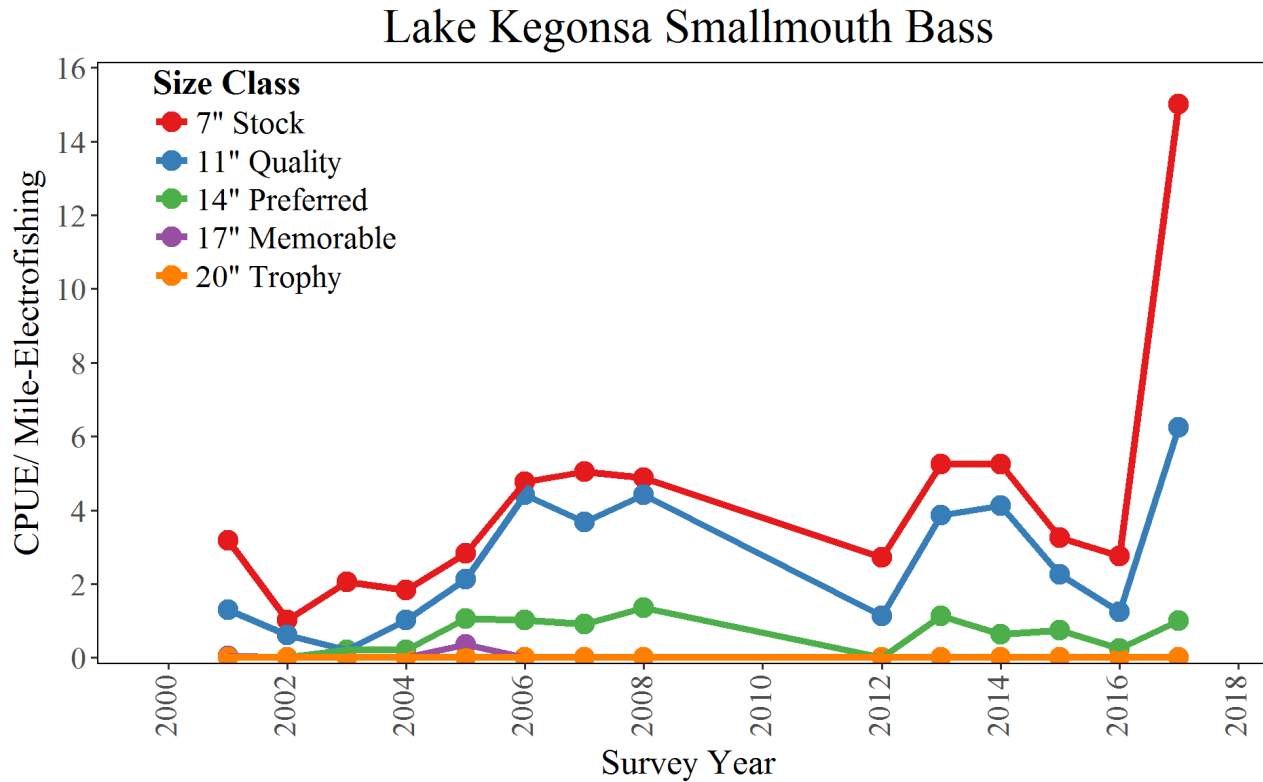


Figure 40. Size-specific catch rates for Lake Kegonsa Smallmouth Bass 2001-2017 indicating a modest but stable population across all size-classes from 2001 to 2015 and an increase in Stock, Quality, and Preferred size-classes in the two most recent surveys.

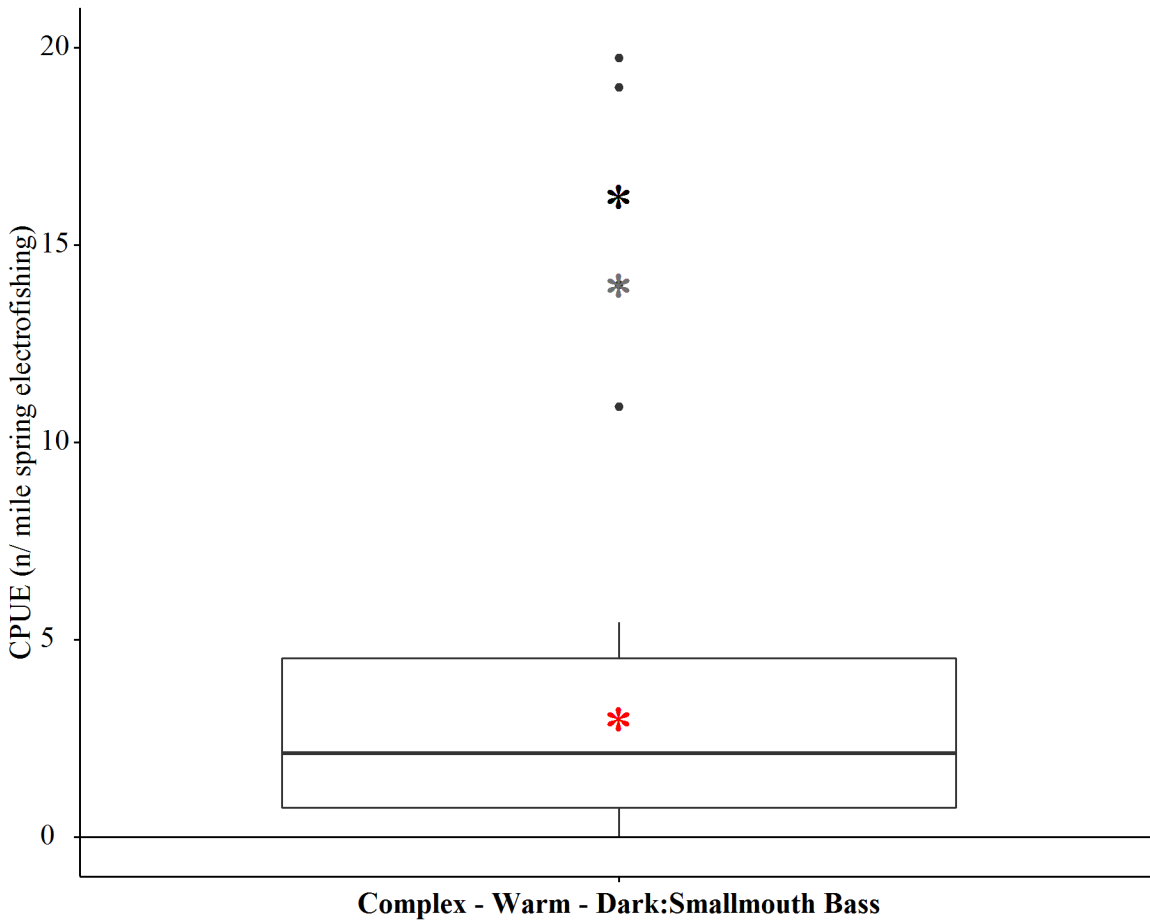


Figure 41. 2016 Lake Kegonsa smallmouth bass catch rates for 2016 (red asterisk), 2017 (black asterisk), and 2018 (gray asterisk) compared to catch rates of twenty-six lakes similar to Lake Kegonsa (boxplot, lower line of box indicates 25th percentile, middle line of box indicates 50th percentile/ median, upper line of box indicates 75th percentile, upper and lower whiskers represent data outside the upper and lower quartiles. Single filled points indicate statistical outliers.

Lake Kegonsa Smallmouth Bass Age Estimates 2016

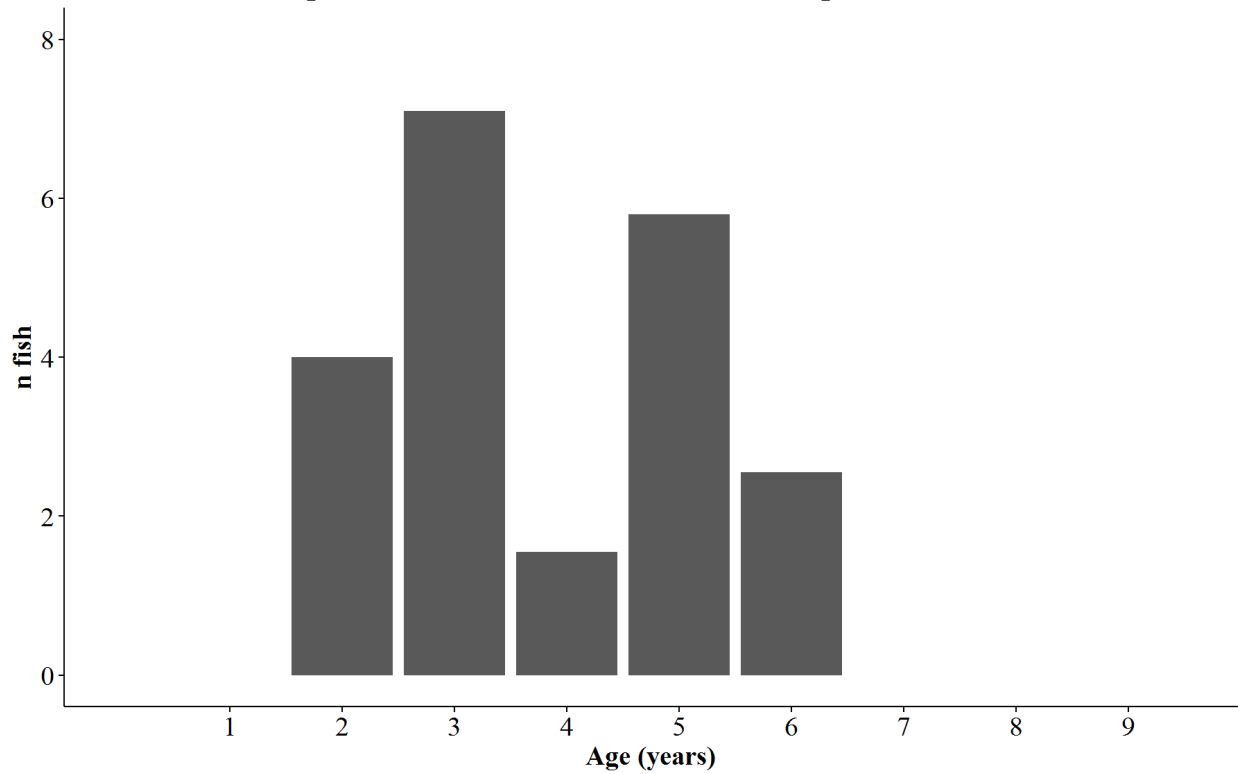


Figure 42- Lake Kegonsa Smallmouth Bass age demographics. Data derived from 22 sampled fish using dorsal spine samples to develop a length-at-age key.

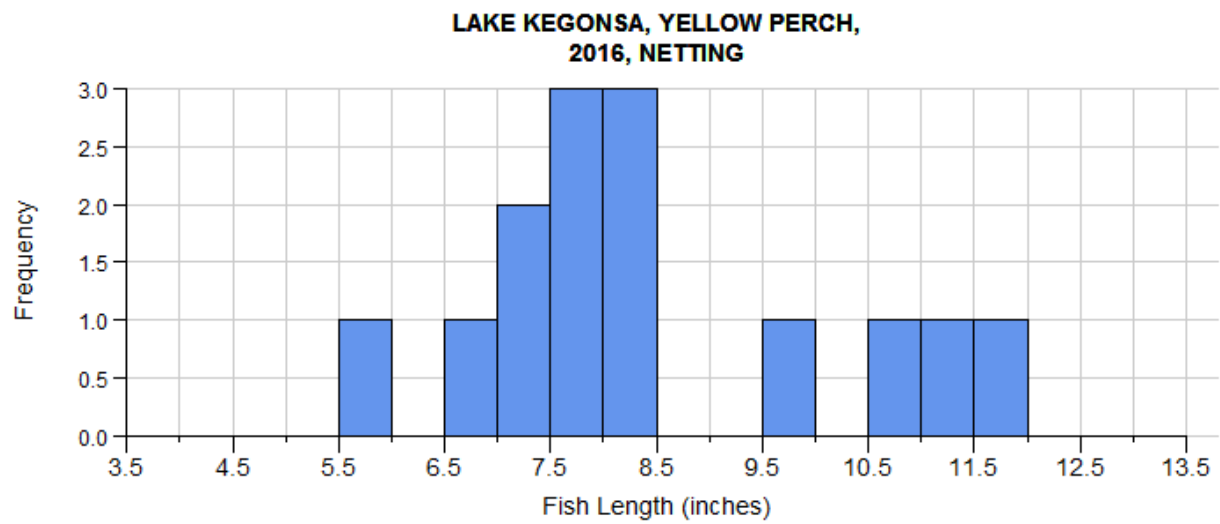


Figure 43. Lake Kegonsa Yellow Perch length-frequency diagram from electrofishing survey conducted in spring of 2016.

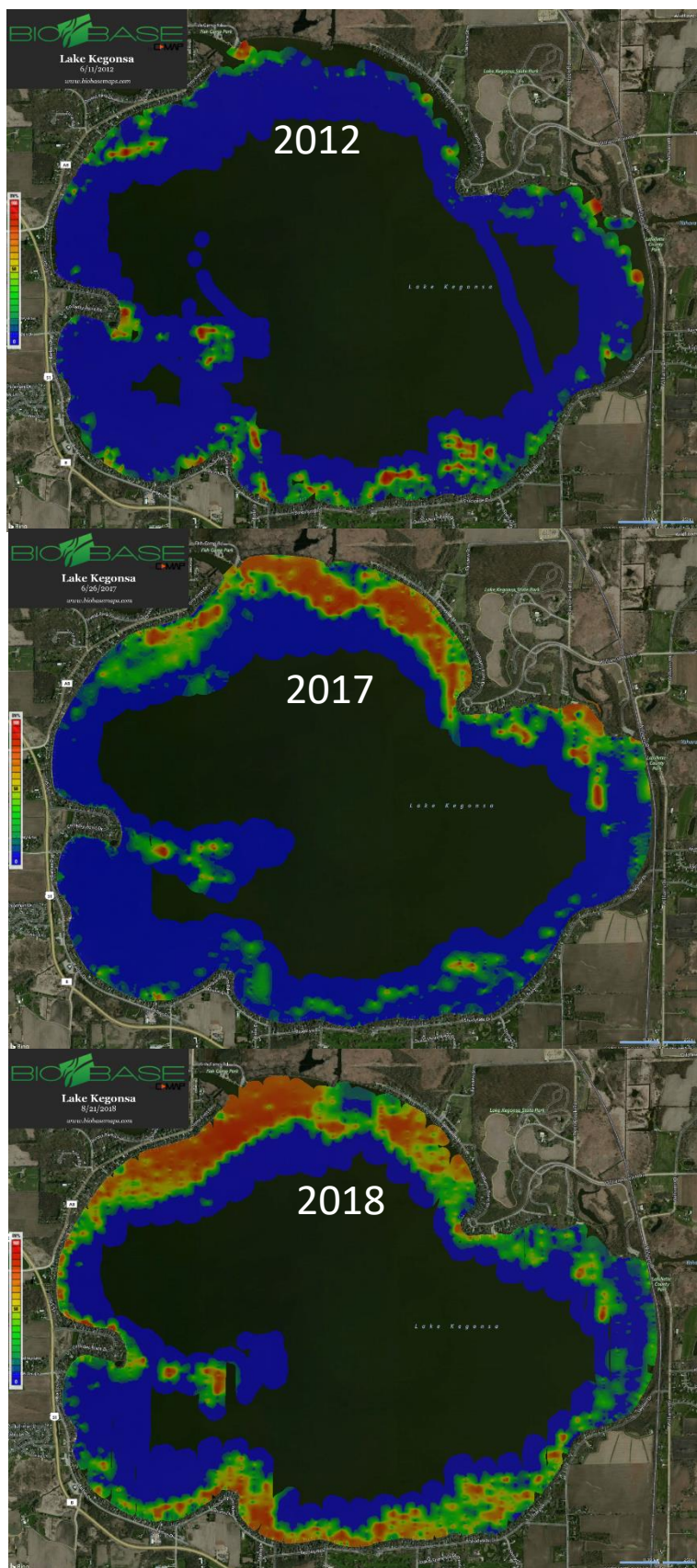
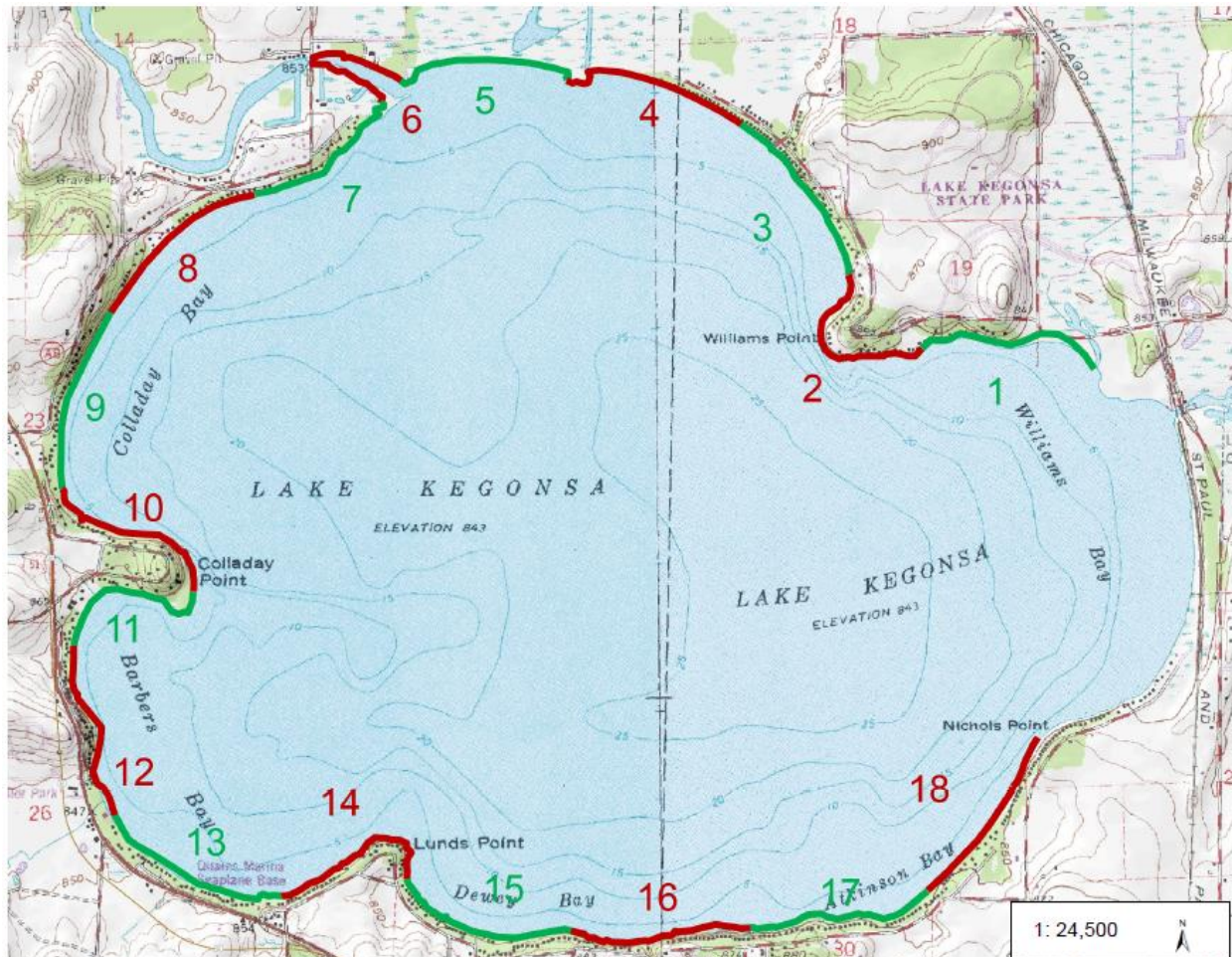


Figure 44. Lake Kegonsa plant density surveys in 2012, 2017, 2018 showing increases in overall extent and density of aquatic plants in the lake. Warmer colors (reds) indicate more aquatic plant cover than

cooler colors (green) and no vegetation present is indicated in blue. Black areas are outside of the photic zone (too deep for plant growth) and are were not surveyed.

Appendices



Appendix Figure 1. Half-mile electrofishing transects for standard WDNR surveys of Lake Kegonsa.

Appendix Table 1. Size-specific length categories for each species used in this report.

Species	Stock	Quality	Preferred	Memorable	Trophy
Black Crappie	5	8	10	12	15
Bluegill	3	6	8	10	12
Brook Trout (lentic)	8	13	-	-	-
Brook Trout (lotic)	5	8	-	-	-
Brown Trout (lotic)	6	9	12	15	18
Channel Catfish	11	16	24	28	36
Flathead Catfish	14	20	28	34	40
Lake Trout	12	20	26	31	39
Largemouth bass	8	12	15	20	25
Muskellunge*	30*	34*	38	42	50
Northern Pike	14	21	28	34	44
Sauger	8	12	15	20	25
Smallmouth bass	7	11	14	17	20
Walleye	10	15	20	25	30
White bass	6	9	12	15	18
Yellow Perch	5	8	10	12	15

* The Muskellunge Team (August 2008) adopted a "modified PSD" for muskellunge in Wisconsin where "stock" size is 30" (vs. 20") and "quality" size is 34" (vs. 30"; Hanson 1986).

Appendix Table 2. Net locations for spring Fyke netting survey.

2016 Lake Kegonsa Net Locations		
net #	Latitude	Longitude
1	42.95458	-89.27896
2	42.9626	-89.27818
3	42.96188	-89.27574
4	42.9647	-89.27661
5	42.95224	-89.26323
6	42.94942	-89.25039
7	42.95641	-89.23066
8	42.97119	-89.24053
9	42.96154	-89.27476
10	42.953261	-89.265276
11	42.957141	-89.279331
12	42.94964	-89.2552
13	42.96154	-89.2419
14	42.9723	-89.2791
15	42.9793	-89.26663

Appendix Table 3. Age estimates for Walleyes using dorsal spines collected in Lake Kegonsa spring Fyke nets in 2016.

Length Class (inches)	Age Class (years, dorsal spine estimates)											Total
	1	2	3	4	5	6	7	8	9	10	11	
8	1	0	0	0	0	0	0	0	0	0	0	1
9	1	1	0	0	0	0	0	0	0	0	0	2
11	0	1	0	0	0	0	0	0	0	0	0	1
12	0	4	3	0	0	0	0	0	0	0	0	7
13	0	0	12	0	0	0	0	0	0	0	0	12
14	0	1	10	2	0	1	0	0	0	0	0	14
15	0	0	10	2	5	1	0	0	0	0	0	18
16	0	0	7	6	6	3	0	0	0	0	0	22
17	0	0	2	3	6	4	4	0	1	0	0	20
18	0	0	0	1	7	3	0	1	0	0	0	12
19	0	0	0	1	5	3	2	0	1	0	0	12
20	0	0	0	0	0	3	1	1	0	0	0	5
21	0	0	0	0	0	1	2	0	0	0	0	3
22	0	0	0	0	0	2	2	0	0	0	0	4
23	0	0	0	0	0	0	2	0	1	0	0	3
24	0	0	0	0	0	0	2	2	1	3	0	8
25	0	0	0	0	0	0	0	2	1	0	0	3
26	0	0	0	0	0	0	1	0	1	2	0	4
27	0	0	0	0	0	0	0	0	2	1	0	3
28	0	0	0	0	0	0	0	1	1	0	1	3
Total	2	7	44	15	29	21	16	7	9	6	1	157

Appendix Table 4. Age estimates for Northern Pike using anal fin rays collected in Lake Kegonsa spring Fyke nets in 2016.

Length Class (inches)	Age Class (years, anal fin ray estimates)										Total
	1	2	3	4	5	6	7	8	9	10	
9	2	0	0	0	0	0	0	0	0	0	2
10	2	0	0	0	0	0	0	0	0	0	2
12	2	0	0	0	0	0	0	0	0	0	2
14	1	0	0	0	0	0	0	0	0	0	1
15	1	0	0	0	0	0	0	0	0	0	1
16	3	0	0	0	0	0	0	0	0	0	3
17	1	2	1	0	0	0	0	0	0	0	4
18	1	2	1	0	0	0	0	0	0	0	4
19	0	2	2	1	0	0	0	0	0	0	5
20	0	3	6	0	0	0	0	0	0	0	9
21	0	6	5	0	0	0	0	0	0	0	11
22	0	1	6	3	0	2	0	0	0	0	12
23	0	0	8	2	1	0	0	0	0	0	11
24	0	0	8	3	2	1	0	0	0	0	14
25	0	0	4	2	2	1	1	0	0	0	10
26	0	0	4	1	3	0	0	0	1	0	9
27	0	0	1	2	0	3	1	0	1	0	8
28	0	0	2	3	0	0	1	0	0	0	6
29	0	0	2	1	1	2	0	1	0	0	7
30	0	0	2	0	0	0	1	0	1	0	4
31	0	0	1	0	0	1	1	0	0	2	5
32	0	0	0	0	1	2	1	0	0	0	4
33	0	0	1	0	0	1	2	1	0	0	5
34	0	0	0	0	1	0	1	1	0	0	3
35	0	0	0	0	0	1	2	2	0	0	5
36	0	0	0	0	0	0	4	1	0	0	5
37	0	0	0	0	0	2	1	2	1	0	6
38	0	0	0	0	0	1	0	1	0	0	2
39	0	0	0	0	0	0	1	1	0	0	2
40	0	0	0	0	0	0	1	0	1	0	2
Total	13	16	54	18	11	17	18	10	5	2	164

Appendix Table 5. Age estimates for Bluegills using dorsal spines collected in Lake Kegonsa spring Fyke nets in 2016.

Length Class (inches)	Age Class (years, dorsal spine estimates)							Total
	1	2	3	4	5	6	7	
3	3	0	0	0	0	0	0	3
4	5	6	0	0	0	0	0	11
5	0	10	0	0	0	0	0	10
6	0	11	0	0	0	0	0	11
7	0	3	7	0	0	0	0	10
8	0	1	4	4	1	0	0	10
9	0	0	0	2	5	3	1	11
10	0	0	0	0	0	2	4	6
Total	8	31	11	6	6	5	5	72

Appendix Table 6. Age estimates for Black Crappies using dorsal spines collected in Lake Kegonsa spring Fyke nets in 2016.

Length Class (inches)	Age Class (years, dorsal spine estimates)										Total
	1	2	3	4	5	6	7	8	9	10	
4	10	0	0	0	0	0	0	0	0	0	10
5	2	0	0	0	0	0	0	0	0	0	2
6	0	4	2	0	0	0	0	0	0	0	6
7	0	7	0	0	1	0	0	0	0	0	8
8	0	5	0	0	0	0	0	0	0	0	5
9	0	6	4	0	0	0	0	0	0	0	10
10	0	1	4	1	2	3	0	0	0	0	11
11	0	0	1	0	4	6	0	1	0	0	12
12	0	0	0	0	0	0	1	2	1	1	5
Total	12	23	11	1	7	9	1	3	1	1	69

Appendix Table 7. Age estimates for Largemouth Bass using dorsal spines collected in Lake Kegonsa spring Fyke nets in 2016.

Length Class (inches)	Age Class (years, dorsal spine estimates)								Total
	1	2	3	4	5	6	7	9	
6	6	0	0	0	0	0	0	0	6
7	1	2	0	0	0	0	0	0	3
8	0	1	0	0	0	0	0	0	1
9	0	2	0	0	0	0	0	0	2
10	0	7	0	0	0	0	0	0	7
13	0	0	4	0	1	0	0	0	5
14	0	0	0	2	6	0	2	0	10
15	0	0	0	6	3	1	1	0	11
16	0	0	1	0	2	2	1	0	6
17	0	0	0	0	0	2	1	1	4
18	0	0	0	0	1	0	0	1	2
19	0	0	0	0	0	0	0	1	1
Total	7	12	5	8	13	5	5	3	58